4 AUGUST 1960

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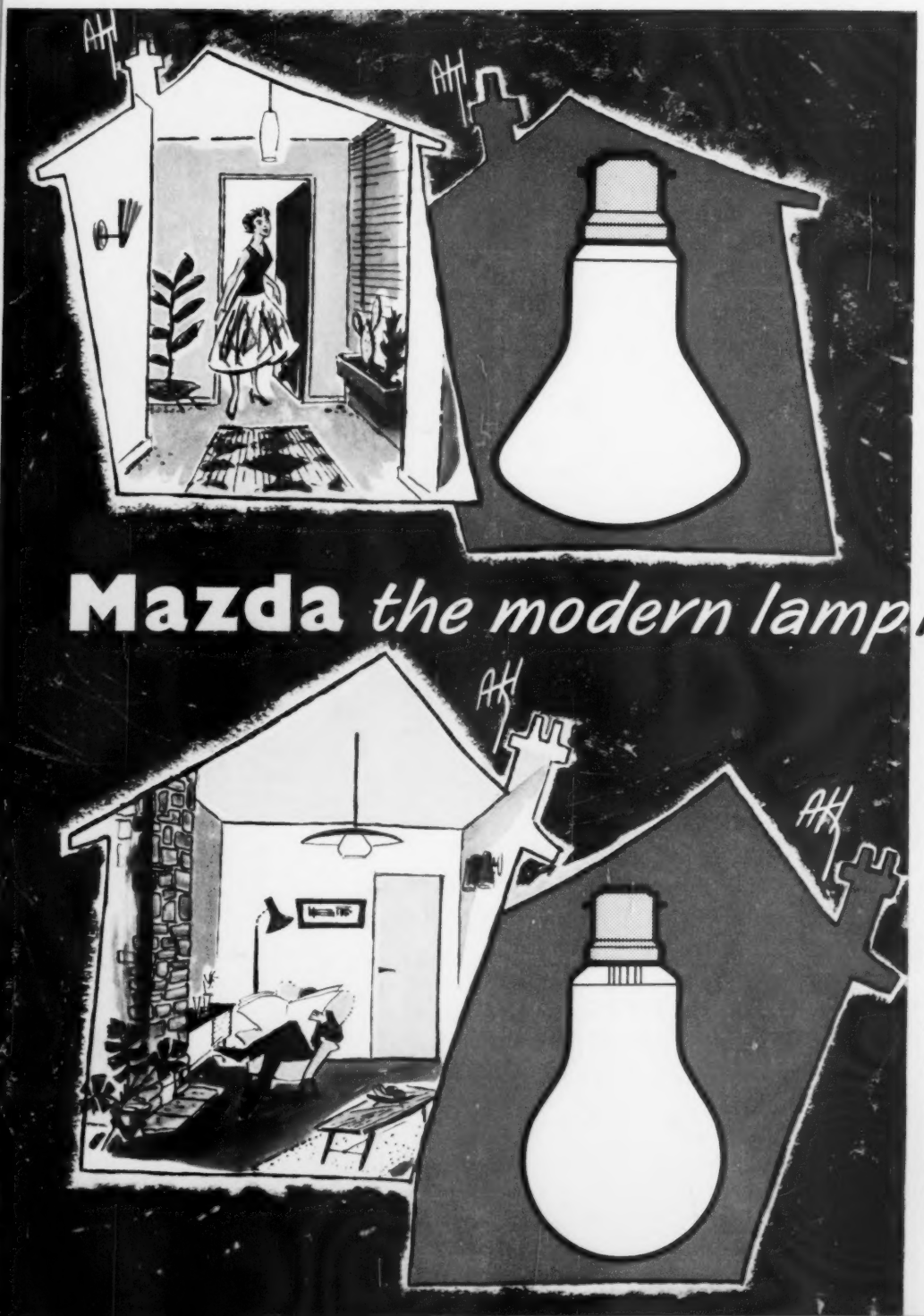

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THE MODERN HOME

The reliable Mazda GLS lamp has been completely restyled to meet the demands of the modern home. Result: the NETABULB. Netabulbs retain all the proven qualities of the ordinary Mazda lamps, but are more pleasing and compact in shape, and provide the advantages of a Silverlight finish.

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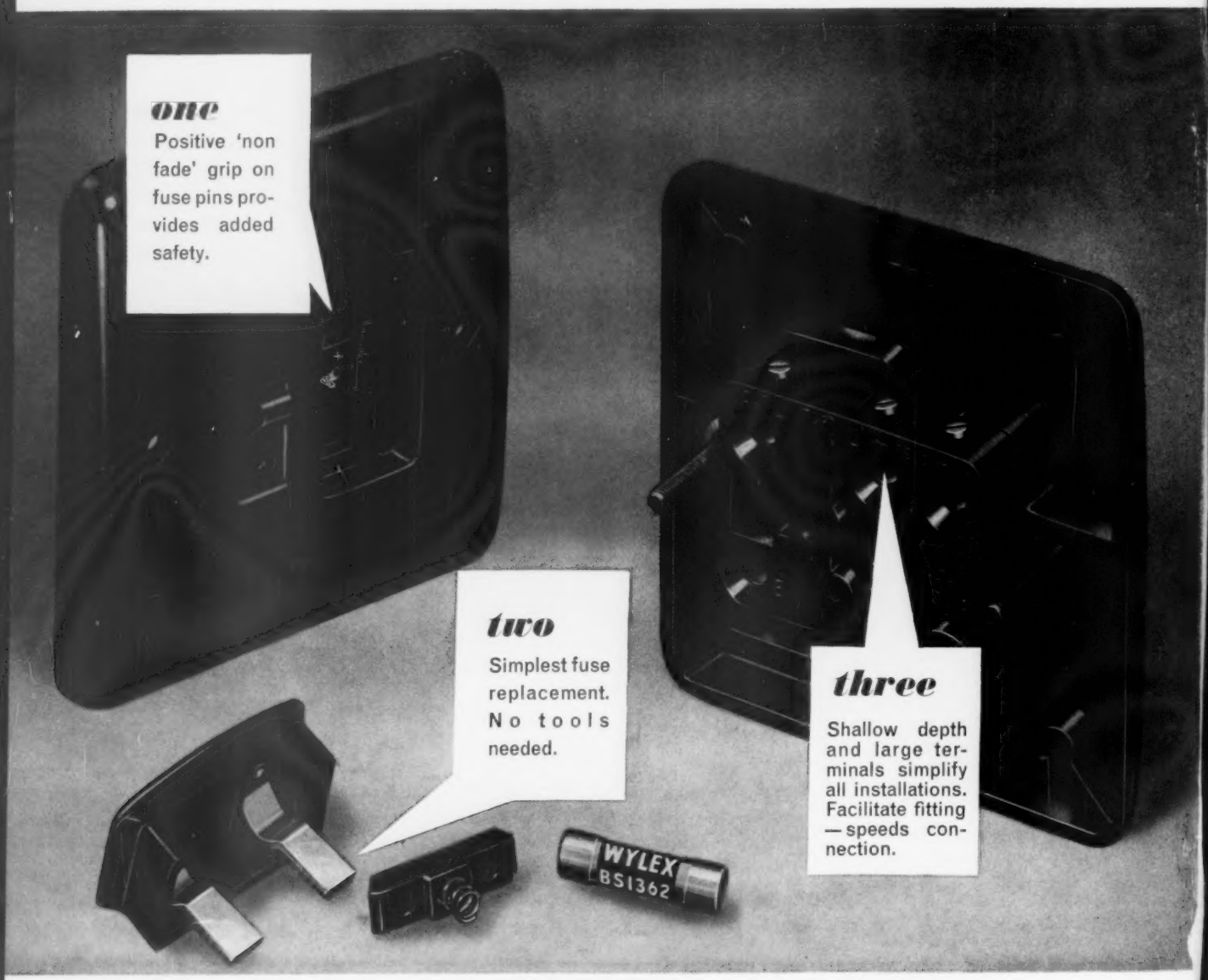
Wylex build quality into SPUR BOXES

in three special ways....


one
Positive 'non fade' grip on fuse pins provides added safety.
two
Simplest fuse replacement. No tools needed.
three
Shallow depth and large terminals simplify all installations. Facilitate fitting — speeds connection.
WYLEX
BS1362

Switched Spur Boxes by WYLEX offer the extra quality that you would expect — and at no extra cost! Featuring the WYLEX DP/AC switch (13 amp.) — proved by years of extensive service. The right choice when connecting fixed appliances to Ring Main Circuits. Fitted with B.S. 1362 cartridge fuse. Made flush to fit Standard Ring Main Box or Surface All-Insulated. With or without Pilot Light, Brown or Ivory.

Wylex build quality into

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SWITCH FUSE
CONTROL UNITS
SWITCHES, SPUR BOXES
PLUGS & SOCKETS

WYLEX

GEORGE H. SCHOLES & CO LTD · Wylex Works · Wythenshawe · Manchester 22

MAJOR ADVANCE IN EPOXIDE SYSTEMS

for electrical insulation

'EPOPHEN' Cold-Setting Epoxide systems—for component potting or encapsulating, bushings, insulators, etc.—are free from handling hazards in the form of dermatitis and eye troubles.

What is more, this major advance in Epoxide systems has been achieved without any sacrifice of other desirable properties; indeed, several additional advantages have been gained, including low exotherm, low thermal expansion, no risk of corrosion of embedded metal parts.

Below are some extracts from the Technical Data on one 'EPOPHEN' Cold-Setting system. If you would like more details about this and other systems (including hot-setting systems), we will gladly send them to you on request.

Resin	EPOPHEN 1075 + 200% Silica Flour
Hardener	EPOPHEN Hardener 1160 (Liquid)
Exotherm*	90°C.
Co-efficient of thermal expansion ($\times 10^{-6}$/°C.)	25
Specific gravity	1·7
Flexural strength (p.s.i.)	14,000
Tensile strength (p.s.i.)	8,500
Tensile modulus ($\times 10^{6}$ p.s.i.)	1·5
Compression strength (p.s.i.)	28,000

*Batch size approx. 7-lb. at an ambient temp. of 15°C /59°F.

T.28

EPOPHEN

EPOXIDE RESINS & HARDENERS

manufactured by

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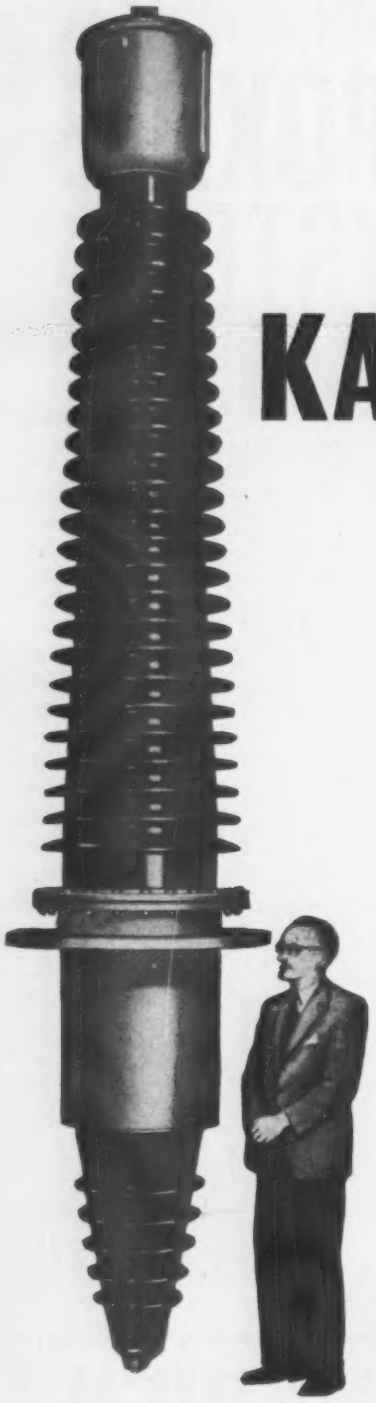

KARIBA at 330 kV.

All the bushing porcelains for the 330 kV. circuit breakers
All the 330 kV. strain insulators for the substations
and the 330 kV. post insulators for some of the substations
by

BULLERS

MAIN CONTRACTORS · A E I LTD.
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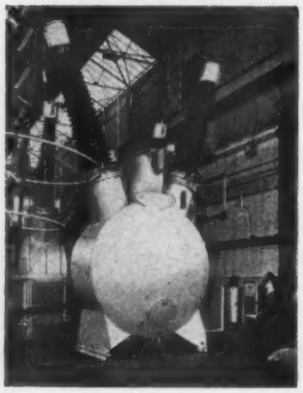

The illustrations show a complete 330 kV. bushing insulator and a 330 kV. circuit breaker, by courtesy of the AEI Ltd.

BULLERS LIMITED · MILTON · STOKE-ON-TRENT · STAFFS

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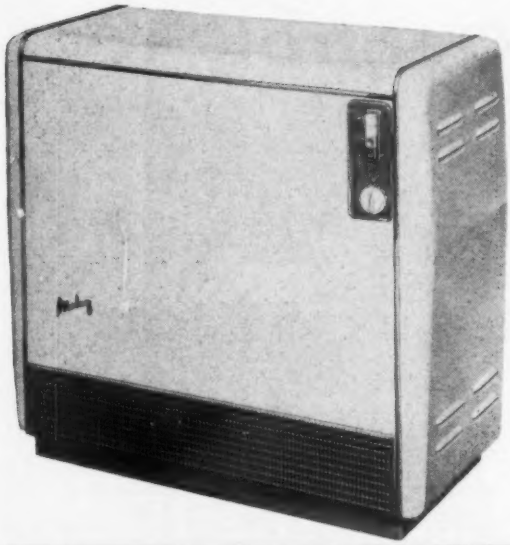
THE MALAG CONTROLLED STORAGE HEATER



- Double the output of conventional Storage Heaters during hours of occupation.
- Core thermostat limits charging to pre-set temperature.
- 25% of output by radiation.
- 75% of output emitted by the fan, controlled by room thermostat.
- Available in 3, 4½ and 6 kw models.
- Super quality vitreous-enamel finish in Bronze or Cream.

HIGH SAFETY FACTOR . . .

Outer casing temperature does not exceed 120° F.

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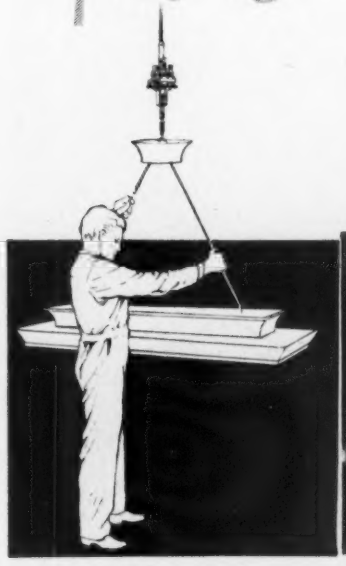
L.E.F. Raising and Lowering gear is the perfect answer to every problem posed by interior lighting installations in which the fitting must of necessity be out of reach and, consequently, tricky to service.

This gear enables maintenance staff to bring lighting fittings down to floor level, so that they can be dealt with quickly and conveniently. It out-dates cumbersome methods and is most economical in time and labour.

When you have a lighting problem, remember that it is most important to discuss your needs with L.E.F. at the planning stage; first to specify your technical requirements and secondly, to ensure suitable delivery.



L. E. F. RAISING & LOWERING GEAR

LONDON ELECTRIC FIRM LTD.

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from simple timing relays
to complete process control
systems

AEI specialists will advise you on...

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- voltage control
- photo-electric process control
- control of resistance welding
- remote control of cranes
- machine-tool control

Please write for technical data.

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Dynamic NEW lighting...

As the basis for new and ever more ingenious lighting arrangements, 'Flo-line' fittings open up for the lighting specialist tremendous opportunities for developing new business.

BENJAMIN REGD. FLO LINE

for those who design with light

'Flo-line' combines the outstanding efficiency of Benjamin fluorescent lighting with exciting and original design of an outward simplicity, making for easy harmony with decorative schemes.

The minicell louvre is combined in one unit with translucent side panels to make an all plastic diffuser of entirely new characteristics.

Comfortable yet cheerful seeing conditions are ensured, with high illumination values.

Controllable upward light. Ceiling or pendant mounting. Access to lamps and control equipment is quick and easy. Side panels are double walled for strength.

Apparent depth of fitting only 3½ in. Total depth 4⅛ in. Half inch cube spaces in louvre give 45° cut-off.

Installation accessories include couplers for continuous line arrangements and channel junction boxes for geometrical layouts.

Uses 2 x 5 ft. 80-Watt lamps.
Quick or switch start control gear.

The entire louvre swings down for cleaning and maintenance.

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BRITISH STANDARD DIMENSIONS

CLASS 'E' INSULATION

OTHER MOTORS up to 1000 H.P. and GENERATORS up to 700 kVA

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SAVES: INITIAL COSTS, INSTALLATION COSTS, PRODUCTION MAINTENANCE

Rollpin is a slotted and chamfered cylindrical spring pin, heat-treated for maximum toughness, resilience and shear strength.

Simple to insert or remove, Rollpins exert continuous spring pressure against the sides of the hole, preventing loosening by vibration. Dimensions and elastic limits are specially engineered to give this self-locking action in drillings to normal production tolerances. No reaming or secondary operations are required.

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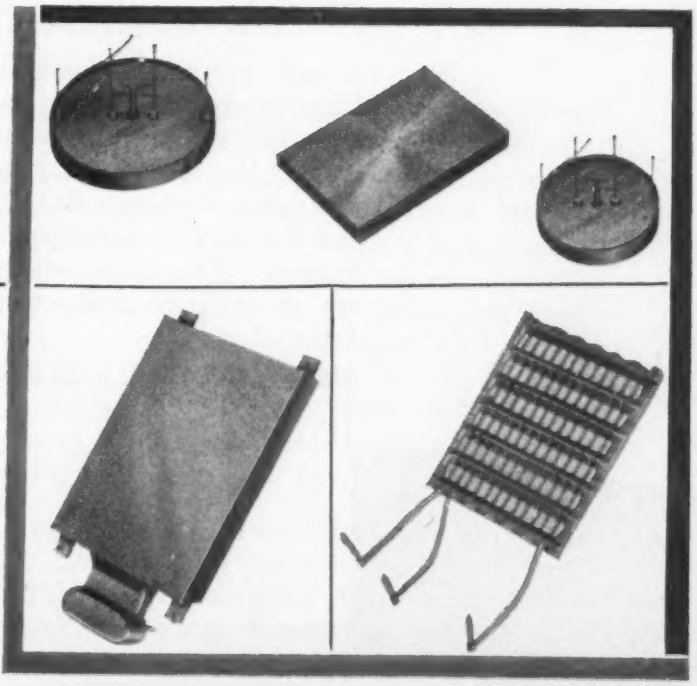

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Individually packed in cartons to facilitate storage.

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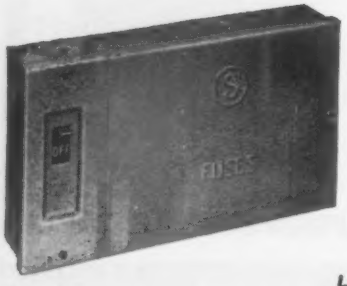
A new competitive range of Consumers' Electricity Control Units in attractive sheet steel cases with ample knockout holes and finished steel hammered grey stove enamel, having 60 ampere Double Pole AC Main Switch and Single Pole and Neutral fuse ways, with porcelain " Duplex " units of 30 amp, 15 amp and 5 amp 250 volt capacity, having rewirable or H.R.C. fuse carriers. The cases, which are complete with earthing bars, are so designed that any combination of these fuses may be fitted at will.

PRICES & DETAILS, SEE LEAFLET 59/59



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NEWS SHEET

House of Commons to change plans for debating nationalised industries; pre-Christmas debate will cover autumn statement on investment; two more days for debating Select Committee reports on the industries. (155, 183)

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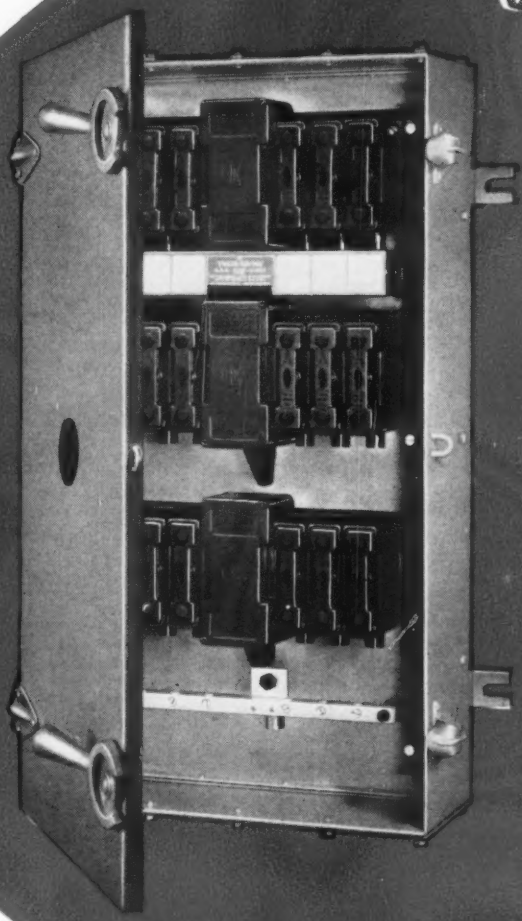
RED SPOT

Heavy Duty

FUSEBOARDS



500 volts
15, 30, 60
and 100 amps

Phase busbars and incoming cable sockets are enclosed in solid insulation. This feature coupled with the shrouding of fuse contacts and terminals permits spare ways to be cabled in safety while existing circuits are on load.

Full details are given in PUBLICATION FG/138.

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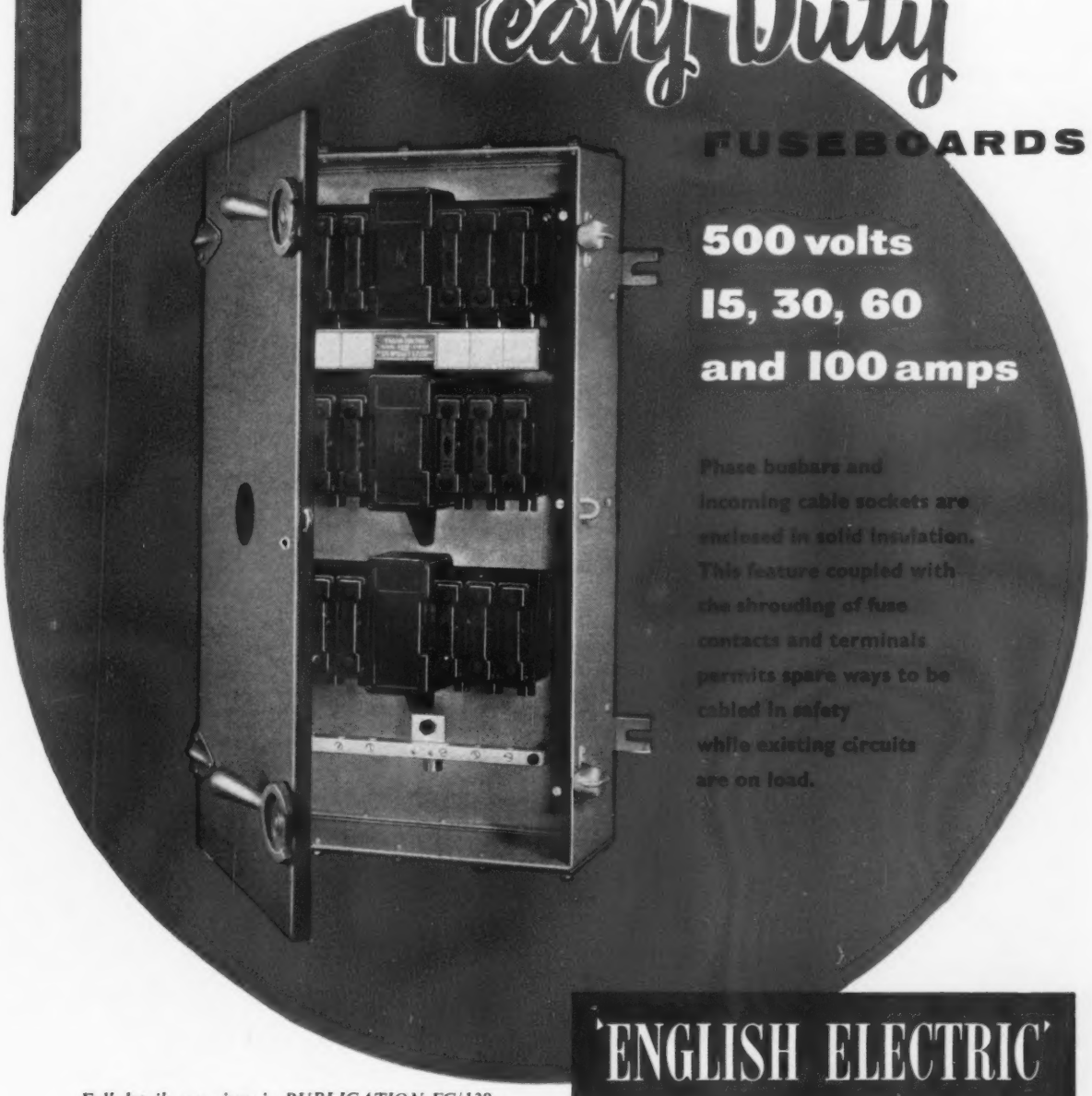

500 volts
15, 30, 60
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- **Fixed type for either back or front of panel mounting**
- **Horizontal draw-out** *(as illustrated)*
- **Metal enclosed**
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20 Amp. and 30 Amp.
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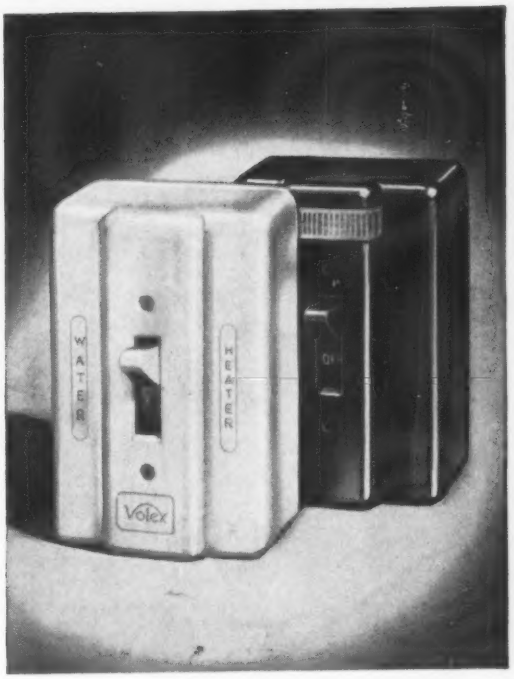

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20 AMP. A.C.

V/5303	Without Pilot light ...	6/8d. each
V/5303CR	„ „ Cream	7/8d. „
V/5304	With Pilot light	9/- „
V/5304CR	„ „ Cream	10/- „

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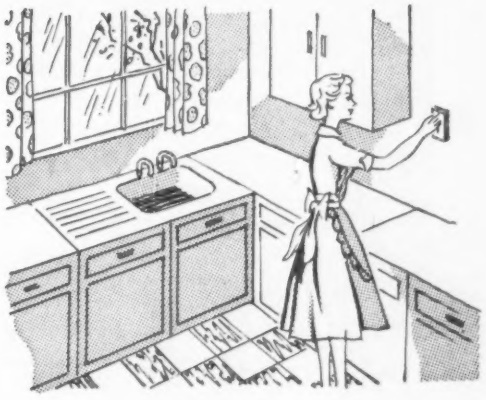
V/5203	Without Pilot light ...	7/8d. each
V/5203CR	„ „ Cream	8/8d. „
V/5204	With Pilot light ...	10/- „
V/5204CR	„ „ Cream	11/- „



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METER BOARDS ARE BEST!

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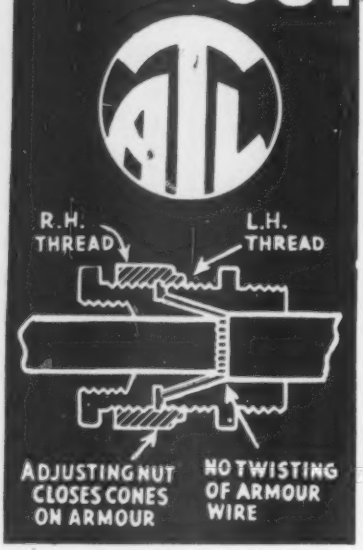

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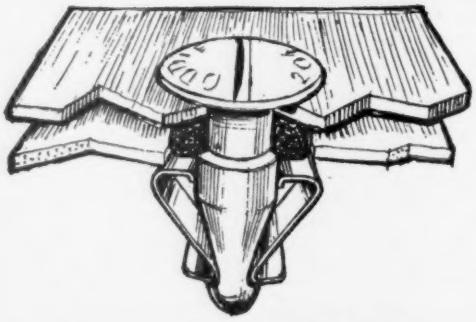

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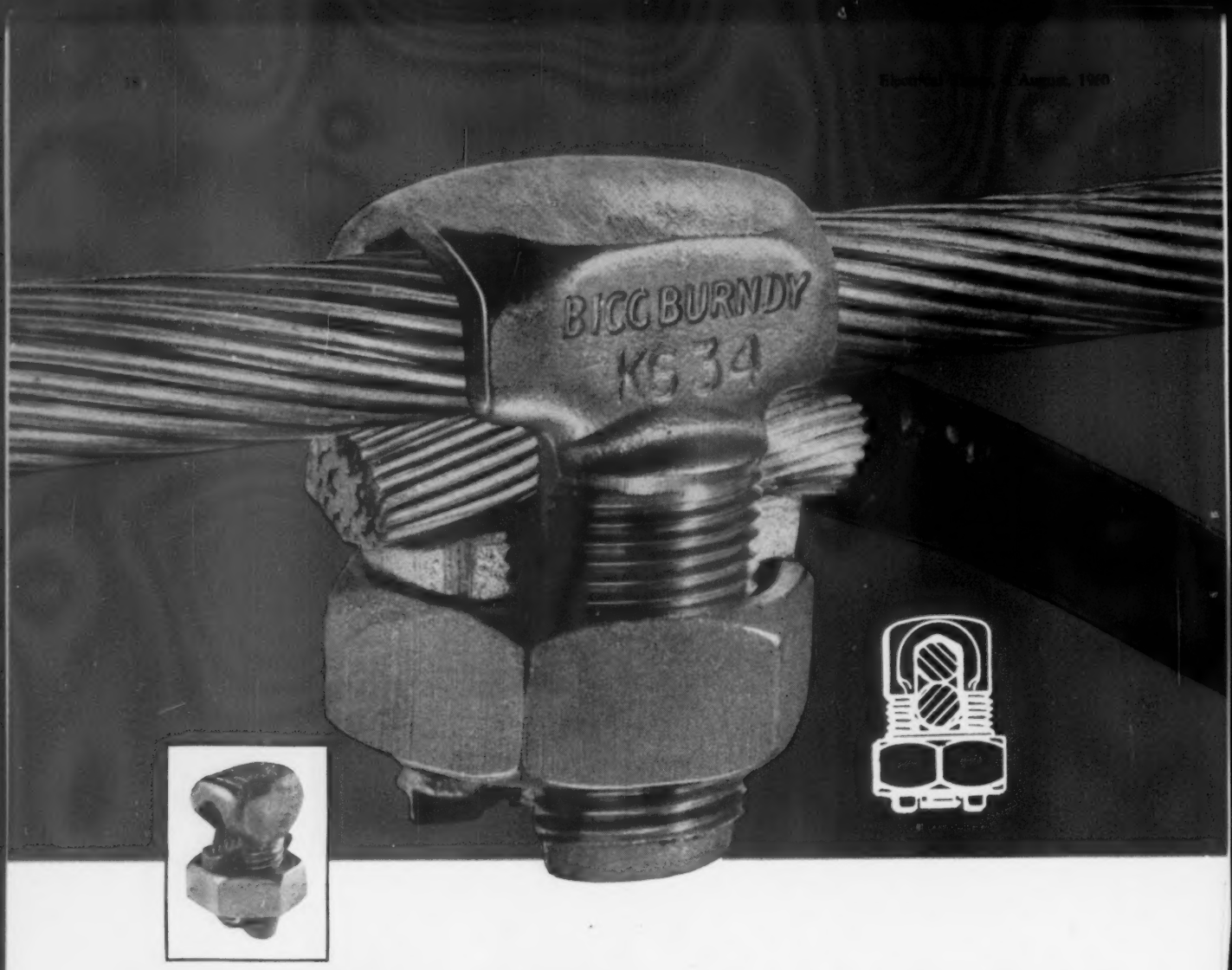

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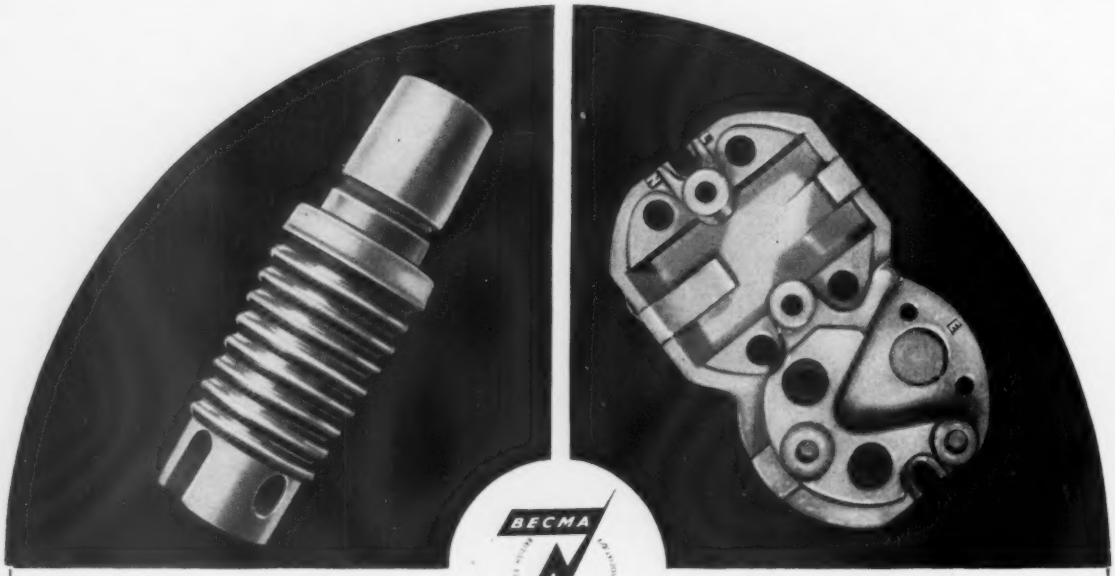

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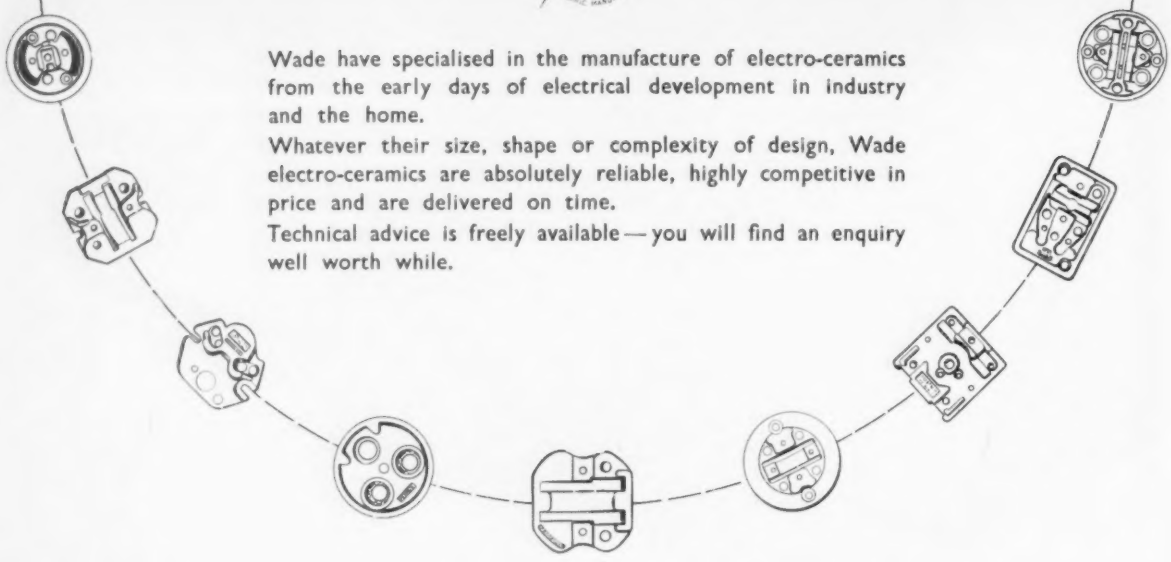

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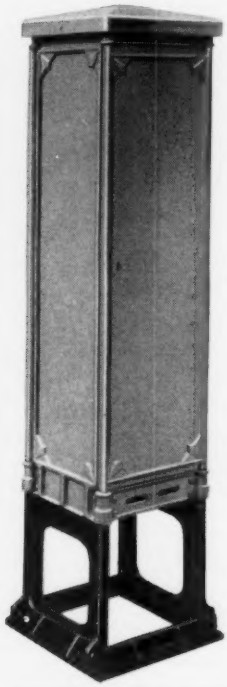

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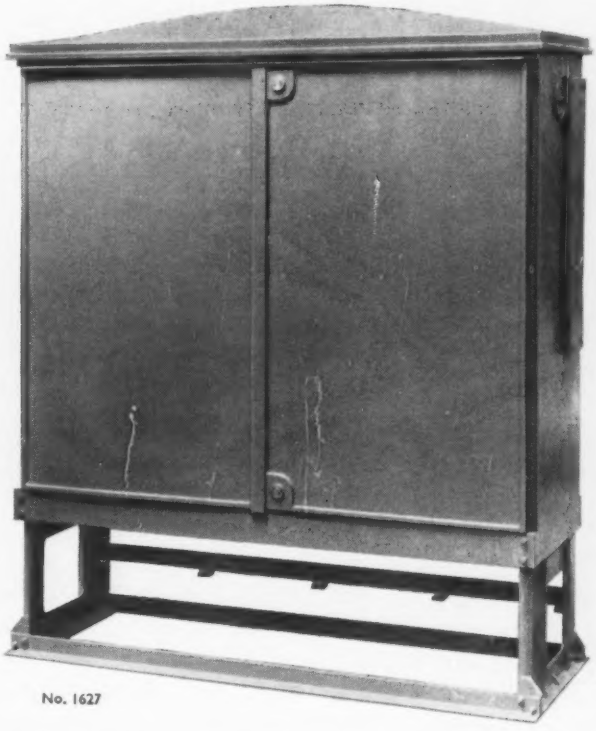

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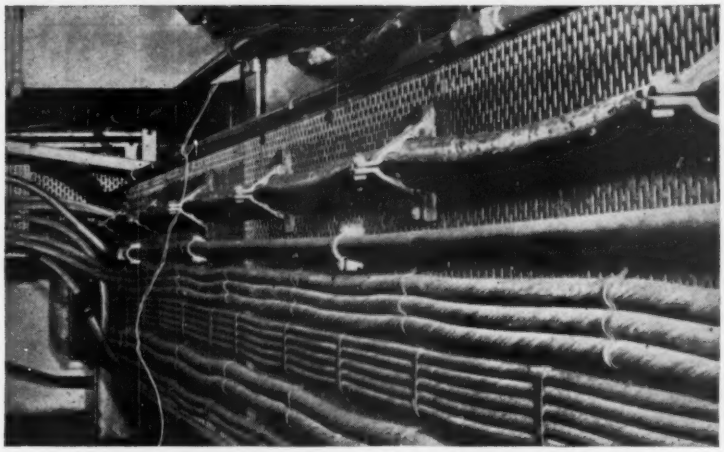

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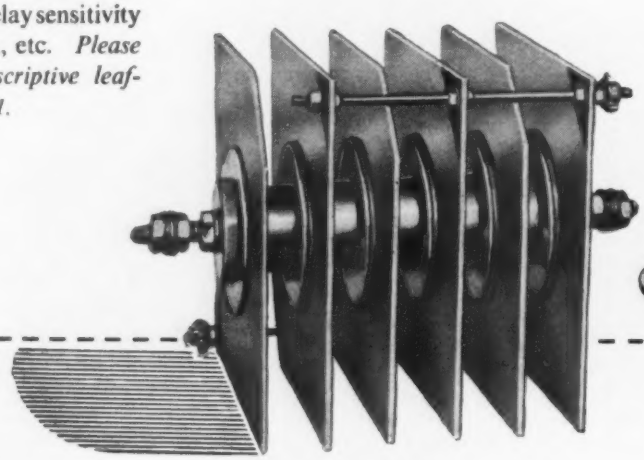

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INSTRUMENTATION DIVISION - Scientific Apparatus & X-Ray Department

Associated Electrical Industries Ltd.

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N/M501

THURSDAY 4 AUGUST, 1960
Registered as a Newspaper Volume 138 No. 5

ELECTRICAL TIMES

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2
Telegrams: Equivolt . Estrand Telephone: HOLborn 6016

Dans ce numéro

Dispositif d'Excitation Rapide pour Grosses Génératrices ... 157

Un régulateur de tension donnant une réponse rapide pour une grosse génératrice, est basé sur l'emploi d'amplificateur magnétique et d'un alternateur pilote (400 hz). L'alternateur incorpore un dispositif limiteur de l'angle de rotor de la machine. Les resultats des essais confirment la valeur de l'apport du régulateur en ce que concerne la fonctionnement du système, avec des groupes travaillant dans les limites de stabilité dynamique. On estime que la limitation d'angle de rotor doit être largement appliquée.

Disjoncteurs Haute-Tension ... 163

On a étudié, au cours de la récente conférence de la CIGRE, un défaut des systèmes de transport d'un type relativement nouveau: le défaut "kilométrique". Il se caractérise par un court-circuit, sur une ligne de transport haute-tension, à proximité d'un disjoncteur, causant un taux très élevé d'accroissement de tension de réamorcage. L'impression générale fût que si les disjoncteurs à soufflage d'arc par air comprimé sont sensibles à ce genre de défaut, ils pourraient cependant être conçus pour fonctionner de façon satisfaisante. On a aussi discuté de l'emploi de pressions plus elevées sur les disjoncteurs à soufflage d'arc par air comprimé, et de l'hexafluorure sulfurique comme gaz d'extinction d'arc.

Refroidissement Diesel ... 167

Parmi les suggestions faites à une Conférence Mondiale de l'Energie récente, se trouve celle de l'utilisation de la chaleur dissipée par les moteurs diesel, pour fair fonctionner un réfrigérateur à absorption, qui, à son tour, refroidirait l'entrée d'air, permettant ainsi d'augmenter la puissance nominale du moteur. Ce système permettra vraisemblablement des économies sur les frais de capitaux et les frais d'entretien dans les centrales à géneratrices à moteurs diesel multiples.

In dieser Nummer

Ein neues schnellwirkendes Erregersystem im Grossgeneratorbau ... 157

Ein besonders schnell ansprechender Spannungsregler für Grossgeneratoren basiert auf die Verwendung magnetischer Verstärker und eines mit 400 Perioden in der Sekunde arbeitenden Wechselstrom-Hilfsgenerators. Dieser enthält ausserdem eine Vorrichtung zur Begrenzung des Läuferwinkels der Maschine. Probeläufe haben bewiesen, dass bei gleichzeitiger Verwendung von Generatorsätzen, die im schwingungsfreien Bereich arbeiten, dieser Regler wertvolle Dienste im Netzbetrieb leisten kann. Für die Läuferwinkelbegrenzung werden vielfache Anwendungsmöglichkeiten in Aussicht gestellt.

Hochspannungs-Ausschalter ... 163

Auf der küzlich abgehaltenen CIGRE-Tagung stand ein relativ neu in Erscheinung getretener Netzfehler zur Diskussion und zwar der sogenannte "kilometrische" Fehler. Dieser besteht im Wesentlichen darin, dass in der Nähe eines in einer Energieleitung gelegenen Ausschalters ein Kurzschluss entsteht, der einen sprunghaften Ansteig in der Zunahme der Wiederzündungsspannung zur Folge hat. Die Diskussionsteilnehmer waren alle mehr oder weniger der Ansicht, dass Druckluftschalter, die bisher als besonders empfindlich gegen Betriebsfehler dieser Art gegolten haben, sich doch so konstruieren liessen, dass sie eine befriedigende Lösung des gegenständlichen Problems darstellen könnten. Diskutiert wurde ebenfalls die Anwendung höherer Betriebsdrucke bei Druckluftschaltern sowie die Verwendung von Hexafluorschwefel als Druckgas bei der Lichtbogenlöschung.

Kühlgeräte an Dieselmotoren ... 167

Auf einer kürzlich abgehaltenen Tagung der Weltkraftkonferenz wurde u.A. vorgeschlagen, die Abhitze aus Dieselmotoren zur Betätigung eines auf dem Prinzip der Absorption beruhenden Kühlgeräte zu verwenden, das seinerseits zur Kühlung der Verbrennungsluft herangezogen werden könnte, womit eine Erhöhung der Motorenleistung zu erzielen wäre. Eine Anordnung dieser Art dürfte Einsparungen an Investierungs- und Betriebskosten bei Kraftwerken mit vielmotorigem Dieselantrieb ergeben.

Fast Excitation Systems—No. 1, G.E.C. 157
by K. C. Parton, B.SC., A.M.I.E.E.

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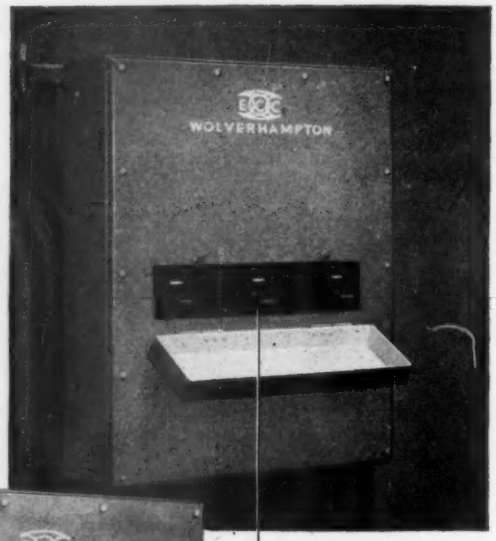

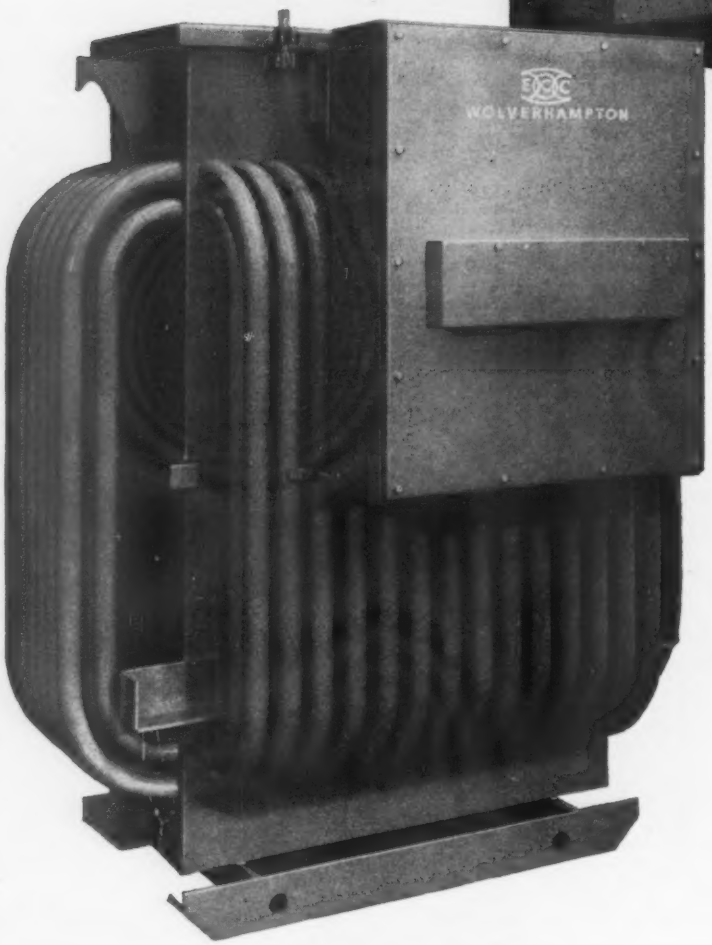

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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 4 AUGUST, 1960

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Comment

E.F.T.A. - E.C.M. ALIGNMENT FOR STANDARDS

The serious risk that the six member countries of the European Common Market would proceed to draw up engineering standards on a basis of mutual agreement, without reference to the rest of Europe, has diminished with the formal acceptance that the seven members of the European Free Trade Association should join in the discussions on standardisation. It is understandable that against this background BEAMA should publish a policy statement calling for full co-operation by its representatives in the task of reaching common agreement, with Western European standardisation coming first as an object, though with the long-established organisations such as ISO, IEC and CEE well in mind. But even in the policy statement, it is recognised that a price has to be paid for agreement. The principles to which British representatives are adjured to have regard include a "willingness to effect reasonable compromise" with other participating countries, which implies some willingness to withdraw from insisting on what one is convinced is the best. This may work well enough so long as the carefully fostered sense of unity amongst the Six, something much stronger than anything the Seven can boast, does not lead to representatives from the countries concerned arguing too often and too insistently a common line. But it should not require long experience to see which way that situation is developing. If all goes well, then the new arrangement will provide another stepping-stone in the link industry is providing between the Six and the Seven as an alternative to the hoped for "bridge" which negotiation at top political level so notably failed to secure.

A WORD FOR M.P.'s

Ever since the first post-war batch of nationalisation, Parliament has been grappling with little success with the problem of letting M.P.'s have their say about boards while letting those boards go forward with their essential tasks without constantly having to look over their shoulder at the sniping politician. In the next Parliamentary session a fresh pattern will apply, affecting the electricity boards equally with other industries. It has two main features, Mr Butler made clear last week. First, on the narrowly financial front, there will be information and a debate in the autumn, covering the investment programmes of all the industries after they have been settled with the Treasury. What the programmes mean in terms of new borrowing will be made clear in the following March, just before the Budget, when the nationalised industries are able to see what degree of self-financing their year's working has made possible. That aspect of the new pattern has many disadvantages,

notably in relation to the risk that party political considerations might enforce some change in agreed investment plans, which for electricity supply would almost certainly mean disruption at the consumer end, as we have often pointed out. The other aspect of the new arrangements is more satisfactory. It envisages abandoning the often dull debates on annual reports and accounts of a specific board, and proposes instead debates (two a year) on the reports of the Select Committee on Nationalised Industries, the committee which produced the recent report on British Railways, for example, and which has already looked into the Scottish electricity boards. Such an approach holds promise of a better-informed debate, with the membership of the Committee itself providing a hard core of contributors who will speak from the extra understanding coming from earlier face-to-face questioning of the chairmen of the boards concerned and their senior officers. The combination of financial checks and consideration of criticisms from a broader basis is far from perfect, but it is at least welcome as a potential improvement on what has applied in recent years.

ULTIMATE IN FAULTS

A condition which many engineers consider will set a new design limit for circuit-breakers in the highest ratings attracted much attention during the recent CIGRE meeting. It has been given the name "kilometric fault," for it is seen at its most severe when a short-circuit occurs at about that distance on the line side of a circuit-breaker, in a system that can develop a very high short-circuit current—in the region of 40,000 amps. In these conditions, the short length of line disconnected from the main part of the system produces, through reflection of travelling waves, a markedly high rate of rise of restriking voltage, which for air-blast circuit-breakers in particular, imposes unusually severe conditions at the moment of interruption of an extremely high current arc. In consequence, the usual rule that heavy short-circuits go with relatively moderate r.r.r.v. is reversed. An answer to this problem is not lacking; the technique of shunting the circuit-breaker contacts with a relatively low resistance seems to work well enough, but not all engineers are in agreement that this is the most desirable approach. The question now requiring elucidation is whether general improvement of circuit-breaker design details suffices to deal with the kilometric fault—a condition for which, incidentally, low oil content circuit-breakers may be inherently better suited than air-blast. There also arises the troublesome decision, whether to call for special tests to check performance of circuit-breakers exposed to this type of fault.

FIRE COSTS

Electricity is commonly blamed as being the most common single cause of fires attended by fire brigades, an allegation based on the fact that about 17% of all fires are reported as being of electrical origin. However, a publication recently issued by the Fire Protection Association much moderates the unfavourable inferences liable to be drawn from such statistics. Electricity, it turns out, is responsible for a far smaller proportion—under 7%—of really large fires (taking £10,000 loss as the criterion); and the fires attributed to electrical causes are not in general the more expensive in this class, so that only about 3% of total fire losses in this big fire category come from electrically-started fires. The article goes on to analyse the experience over recent years in this class, blaming wiring faults and over-fusing as the most prevalent causes of big fires; but the analysis reveals what is so commonly the case with smaller fires as well; that to call them "of electrical origin" is a little misleading. The many cases where the cause was overheating from an electrical heater or a smoothing iron switched on is a case in point; relatively seldom is an electrical fault involved, the fault is in the use or application. The official answer to criticisms about including such incidents in the "electrical origin" classification is that the fire risk is less obvious with electrical heating than with other means. This is, at best, a questionable judgment, for the unobtrusiveness of fire risk springs in part at least from the high standards of construction incorporated in most British electrical equipment, itself a positive influence against fire raising.

E.D.A. LIKES HARROGATE

The EDA sales conference will be held in Harrogate again next year. Behind this simple statement is an important policy decision, reversing the recent practice of a London venue for the conference every alternate year. No doubt this change arises from the aura of success which was plainly apparent at Harrogate earlier this year. This annual conference has been growing in importance in recent years by reason of its down-to-earth papers and hard-hitting discussions, but at this year's meeting, the grafting on of the former BEPC exhibition gave a fillip to the conference and added a focal point which is so valuable on such an occasion. Now EDA is to ask manufacturers whether they will participate in an exhibition at the 1961 conference. It is odds-on that the answer will be "yes," and so the industry will have successfully changed exhibition venues without becoming unhorsed. And if an exhibition is to become a regular concomitant of the conference it would seem that London will no longer be acceptable as a possible venue and preference will be given to the more intimate air of a watering place. But at the risk of offending our Yorkshire friends we would ask, why pick on Harrogate again? The reasons that led to the biennial alternation of the conference between London and the provinces are even stronger in favour of a change of provincial venue each year. A static conference may simplify administration but equally it may lead to a static outlook.

Meteor

This week's quick summary of electrical news faces advertisement page 8

Fast excitation systems

LARGE GENERATOR SCHEMES—No. 1, G.E.C.

by K. C. Parton.* B.Sc., A.M.I.E.E.

IN the field of control engineering there are often very many alternative methods and types of components that can be used to do very much the same job. This is well illustrated in the field of voltage regulator systems for large turbo-alternators, and to attempt to describe all these possibilities would be too much for one article. Instead it is proposed to centre this article around one particular modern regulator that has proved popular and successful in service.

The design and site performance of this regulator are described and both aspects are discussed from the points of view of power system operation and control requirements. In this way it is hoped to provide a relatively full understanding of both one particular regulator and the general requirements of large power systems.

Regulator Design

The regulator to be described is the GEC Type CVR 7, fitted with the rotor angle control unit, Type KAL. This equipment provides a comprehensive static alternator excitation control system using magnetic amplifiers and giving a continuously-acting voltage control with no inherent dead-band. Briefly, the main features that have been incorporated are the use of static components to the exclusion of rotating machines as far as practicable; the use of 400 c/s supply for the magnetic amplifiers; a high accuracy neon reference tube circuit employed for the voltage control and a hand excitation system employing an induction regulator which is used for smooth stepless control. The latter feature is so integrated with the automatic voltage regulator control that there is a minimum of switching necessary in changing from hand to a.v.r. control and vice-versa. The only rotating machines used are the main exciter and the 400 c/s self-excited pilot alternator.

The basic diagram of the regulator is shown in Fig. 1, where all the principal components are shown.

Item A is the three-phase homopolar pilot alternator giving an output of 200 V r.m.s. to line at 400 c/s. This set is self-excited by a Boucherot circuit to ensure that the excitation system is independent of auxiliary supplies and is also current compounded to keep a constant output voltage. A homopolar machine is selected for maintenance reasons, for it means that both field and output windings are wound on the stator so that there are only static connections, i.e., no commutators or slip-rings are necessary. The use of the higher frequency is a great advantage, since it allows the magnetic amplifiers to give a much faster response to system fluctuations, and greatly reduces the size of all the iron-cored components.

On hand control, the output of the pilot alternator is controlled and rectified by the auto-excited magnetic amplifier combination MA_1 and fed to the main exciter field. The control signal for the main control winding of MA_1 is obtained from an induction regulator I.R. This arrangement produces stepless excitation control from minimum to c.m.r. The induction regulator is motor-driven, the direction of rotation being controlled by the hand-control "raise" and "lower" relays, which are themselves energised by hand controllers on the a.v.r. cubicle and in the control room.

To provide for emergency operation, the induction

* Mr Parton is with the General Electric Co. The article is based on a lecture in a series on fast excitation systems for modern turbo-alternators, held at the Borough Polytechnic. (Organising lecturer, Mr L. F. Spence.)

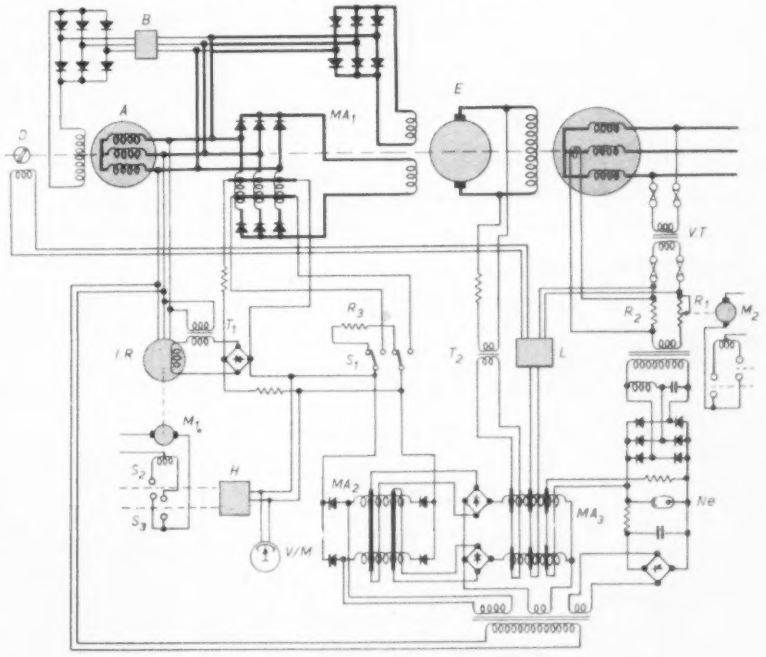


Fig. 1. Basic diagram of GEC voltage regulator

A	Pilot alternator	MA_1	Main magnetic amplifier	R_1	AVR setting resistor
B	Self-excitation circuit for pilot alternator	MA_2	2nd stage magnetic amplifier	R_2	Current compounding resistor
D	Rotor angle transmitter	MA_3	1st stage AVR magnetic amplifier	R_3	AVR dummy-load resistor
E	Main exciter	M_1	Hand-control induction regulator motor	S_1	Hand/auto change-over relay
G	Main alternator	M_2	AVR setting-resistor motor	S_2	Hand control "raise" relay
H	Hand follow-up circuit	Ne	Gas-filled reference tube	S_3	Hand control "lower" relay
I.R	Induction regulator	V.T.	Voltage transformer	T_1	Reference transformer for I.R.
L	Rotor angle limiter			T_2	Stabilising transformer
				V/M	Null balance voltmeter

regulator may be directly hand-operated from a handwheel on the front of the a.v.r. cubicle. The handwheel is geared directly to the induction regulator, the gearing being engaged only when the handwheel is unlocked and then held in against a disengaging spring.

To go on to automatic control, all that is necessary is first to adjust the a.v.r. setting by resister R_1 until the net output into dummy resistor R_3 is zero as indicated on the null-balance voltmeter V/M, and then to close the change-over switch S_1. The hand control circuit stays in circuit under all conditions and has no relay contacts in its circuit.

When on automatic voltage control, the alternator terminal voltage is fed to the a.v.r. from a voltage transformer VT via the compounding resistor R_2 and the a.v.r. setting resistor R_1. This voltage is converted from single-phase to three-phase, is rectified, smoothed, and then compared with a fixed reference voltage, which is a circuit embodying a special heavy-duty type of neon reference tube. For simplicity of circuitry and reliability, and for the highest accuracy and speed of response, two specially selected industrial neon tubes are preferable to any of the more elaborate types of voltage-sensitive circuits.

Any difference arising between the reference and terminal voltages, is amplified by the magnetic amplifiers MA_3 and MA_2 so that a correction signal is applied to the a.v.r. coil on the main output magnetic amplifier MA_1 either to increase or decrease the excitation as required. The maximum output voltage obtainable from MA_1 is several times greater than that required for maximum steady-state field conditions, so that heavy positive forcing can be obtained. This feature, together with the inherently high speed of response of MA_1 enables rapid control of the exciter field to be achieved.

Once the a.v.r. has changed the excitation, the hand follow-up device will operate to energise the relays of the hand-control circuit so that the current in the hand-control coil on MA_1 is either increased or decreased to take over the excitation of the a.v.r. coil. Thus, when a steady state is again reached, the current in the a.v.r. control coil of MA_1 is reduced to a very small value and the required steady state excitation is supplied almost completely by the hand-control equipment. This has the great advantage of making any emergency trips to hand-control very straightforward, since there is no disturbance to the main excitation equipment and the absolute minimum amount of relay operation. The voltage control accuracy will be within $\pm\frac{1}{2}\%$, this being independent of the hand-control follow-up circuit.

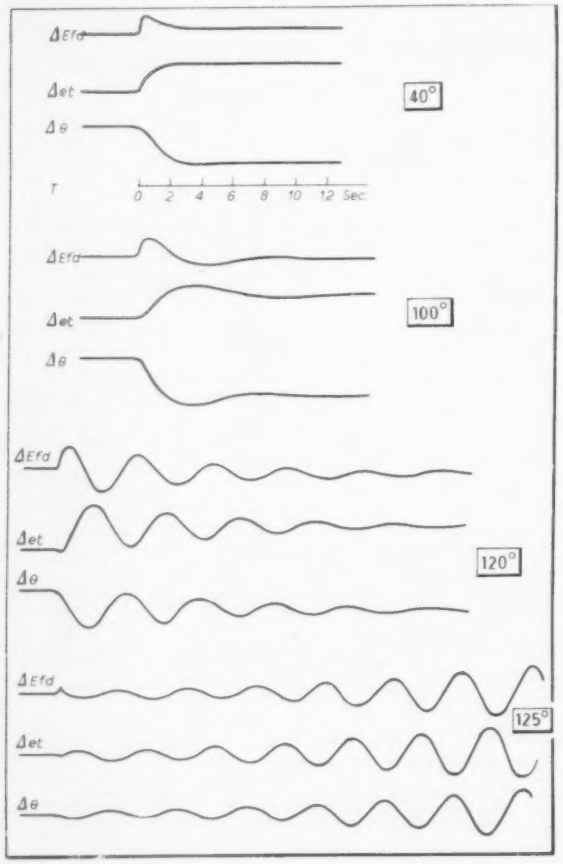


Fig. 2. Transient behaviour of an alternator with regulator control at various load angles

Basic Theoretical Investigations

Due to the non-linear nature of the differential equations describing the full performance of a synchronised alternator controlled by a voltage regulator, it is more convenient to use small oscillation theory and obtain a set of linear equations which apply to any particular operating point. The most convenient of these are those developed by Heffron and Phillips,* which can be written as follows:

$$(1 + pT'_{d_z})\Delta\phi_{fd} = K_3\Delta e_{fd} - K_4\Delta\theta$$
$$\Delta e_t = K_5\Delta\theta + K_6\Delta\phi_{fd}$$
$$(Mp^2 + Dp)\Delta\theta = \Delta T_m - K_1\Delta\theta - K_2\Delta\phi_{fd}$$
$$\Delta e_{fd} = g(p) \cdot \Delta e_t$$

where

T'_{d_z} = equivalent field time constant on load;
$\Delta\phi_{fd}$ = incremental change of direct axis flux;
Δe_t = incremental change of terminal voltage;
$\Delta\theta$ = incremental change of machine load angle;
Δe_{fd} = incremental change of exciter voltage;
M = inertia constant;
D = damping constant;
g(p) = transfer function of the voltage regulator;
K_1 to K_6 = constants for any point of operation of the alternator.

The constants K_1 and K_6 are complicated, but they have been programmed for a digital computer so that a table of results for different load angles can be quickly obtained for any particular machine with any given supply voltage and external system impedance.

The foregoing equations are most suitable for setting on an electronic simulator in order to examine the most suitable voltage regulator design to meet the required conditions. Fig. 2 illustrates typical examples of transient solutions to a small disturbance at machine load angles of 40°, 100°, 120° and 125°. The variation of damping and natural frequency with the machine angle can be

* W. G. Heffron and R. A. Phillips. Effect of modern amplidyne voltage regulators on under-excited operation of large turbine generators. TAIEE, 1952, Vol. 71, p. 692.

clearly seen, leading to eventual loss of stability at an angle of 125°.

By eliminating Δe_{fd}, $\Delta \phi_{fd}$ and $\Delta\theta$ from equations 1—3, and breaking the loop at the terminal voltage point, the following transfer function can be written:

$$\frac{e_0}{e_t} = \frac{-K_3K_2K_5 + K_3K_6(Mp^2 + Dp + K_1)}{(1+pT'd_z)(Mp^2 + Dp + K_1) - K_4K_2} \cdot g(p)$$

This overall transfer function is the product of two parts consisting of the alternator constant and the regulator transfer function. By observing the behaviour of the alternator constant part of the function as the angle is increased, it is possible to study the necessary changes required in the regulator function g(p) in order to maintain stability.

Typical transfer functions are shown in Fig. 3 which shows the system to be conditionally stable in that at load angles greater than 90° there are minimum and maximum overall gain limits for stability.

Rotor Angle Control

Incorporated in the regulator is the rotor angle limiter equipment type KAL, in order to provide a comprehensive alternator control system that ensures complete stability under any steady state system conditions or maloperation, and give maximum protection possible for any system fault conditions.

From the theoretical investigations it becomes clear that the old conception of a twenty/ten per cent power margin as the practical limiting operational condition becomes obsolete when dealing with modern regulators capable of controlling in the dynamic stability region. It therefore becomes necessary to search for some other parameter which can be used as a reliable reference under various operating conditions, and the answer is to be found in the mechanical position of the rotor relative to the infinite busbar, i.e., the machine load angle. From Figs. 2 and 3 it can be clearly seen that there is a significant change in the damping of the system as the maximum stability angle is approached, and it therefore seems appropriate to define the maximum permissible operating point of the alternator as an angle giving a certain angular margin to the known stability limit load angle. In order to test the practical possibilities of this idea, a rotor angle monitoring and control device has been developed and added as an integral part of the voltage regulator design.

Fig. 4 shows the schematic diagram of the rotor angle limiter and control device, the unit marked L in Fig. 1. The circuit is a simple static circuit which results in a large signal being fed to the first stage amplifier MA_3 (Fig. 1) of the voltage regulator whenever the machine angle exceeds a preset value.

Referring to Fig 4 it will be seen that the current i_θ is derived from the vector addition of the terminal voltage e_t and the output voltage of the permanent magnet alternator e_m. When the alternator is unloaded, e_m and e_t are in phase and as the machine angle is increased, this summated voltage will collapse following a cosine curve until at 180° it becomes zero. A pre-set current i_v fed from the terminal voltage is subtracted from i_θ and the difference current $i_\theta - i_v$ is fed to the magnetic amplifier MA5. The latter is so designed that it only gives an output current i_s when $i_\theta - i_v$ is negative, hence whenever the machine angle is small and i_θ is large, there is no appreciable output. Only when the angle becomes large enough for i_θ to drop below i_v does the signal i_s increase, and after a short initial curved portion, become directly proportional to i_θ so that a continuous linear signal proportional to rotor angle is fed directly into the a.v.r. control loop system. The small bias current i_0 and the blocking rectifier REC 8 are employed to ensure that no undesirable leakage current feeds through into the a.v.r. system under normal load angle conditions. The short non-linear entry into the limiter circuit is due to the characteristic of REC 8 and proves valuable in avoiding any sharp step in the overall regulator control. A typical output curve of the unit is shown in Fig. 5.

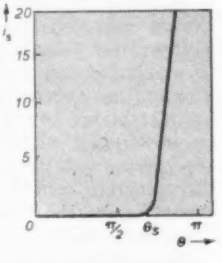


Fig. 5. Typical output curve of rotor angle limiter

The resulting performance of the regulator is that during normal running at load angles less than the setting of the load angle limiter, normal voltage control is in operation with no interference from the angle limiter. When however, the system conditions, or

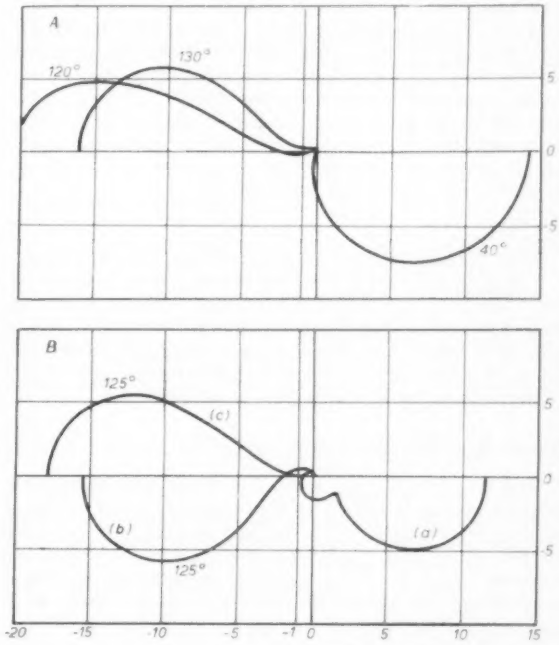


Fig. 3. Frequency-response curves of alternator and voltage regulator. A—combined curves at θ = 40°, 120°, 130°. B—individual and combined curves at θ = 125°; (a) frequency response of regulator only (x10), (b) frequency response of alternator only (x 100), (c) combined regulator and alternator response curve

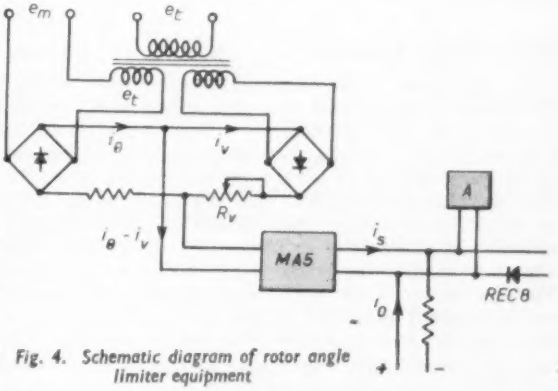


Fig. 4. Schematic diagram of rotor angle limiter equipment

the called-for terminal voltage is such that the machine angle reaches the set limit, the voltage control signal is overridden by a strong rotor angle control signal and the terminal voltage will now automatically take up any value necessary in order to prevent the rotor movement from substantially increasing beyond the set value. This change-over process is quite smooth and automatic, the only indication that the limiter is operating being obtained from a subsidiary transistor detector circuit (A) on the output of MA5 which gives a warning in the control room.

The general stability design of this regulator is such that if desired, the terminal voltage difference signal could be disconnected automatically when the rotor angle limiter is operating so that a tight control of rotor angle is obtained to within 1° for any system alteration.

The use of a mechanical derivation for the rotor angle signal was found very desirable in order to obtain a signal which would remain valid during transient and oscillatory conditions. Equivalent R-L summation circuits were rejected since under dynamic conditions, the equivalent machine angle vector obtained could under unfavourable circumstances, give totally erroneous signals. The output from the rotor angle generator is also used to feed a simple wattmeter type instrument in the control room calibrated in rotor degrees from 0 to 160°. This instrument has proved most useful in day-to-day running as it tells the operator at a glance the stability margin of his alternators without having to refer to any charts or make any correction for voltage.

Site Tests

Site tests have been conducted with the assistance and permission of the CEGB to examine many aspects of this regulator performance under steady state, transient and synchronous conditions. A very valuable and extensive series of such tests were carried out on a 60 MW direct cooled alternator at Poole power station, Dorset.

Transient Performance

The response of the excitation to sudden change of voltage setting is shown in Fig. 6 (a, b and c), where a change of setting is made in each direction. This record shows clearly that despite the absence of any appreciable negative forcing of the exciter voltage, the resultant response of the system in the lower voltage direction is very similar to the raise-voltage performance.

Fig. 7 shows records of the same regulator on open circuit where, it will be noted, that due to the inherent long time delay of the field under open-circuit conditions, there is now more difference in the response in the two directions. Both of these results however, are still satisfactory.

Rotor Angle Limiter

The operation of the rotor angle limiter may be considered equivalent to that of a stiff spring-loaded buffer, so that if the rotor tends to move beyond the set angle, a signal proportional to the excess angle is applied to boost the excitation to prevent further increase of angle. This was demonstrated, with the unit supplying 60 MW, by adjusting the rotor angle limiter to 70° and then reducing the regulator setting until this value was approached, when the limiter began to have some effect. The first result was the operation of the rotor angle alarm, and subsequent reduction of the a.v.r. setting down to the minimum had negligible effect on the terminal voltage and rotor angle. The alternator excitation was now completely determined by the rotor angle limiter equipment, and by altering the adjustment of the limiter, the alternator could be moved round to any load angle within the range of stable operation under normal a.v.r. control. This in effect meant that the alternator was on rotor angle control instead of voltage control.

Tests were then conducted to determine the ability of the limiter to prevent a machine falling out of step under adverse transient conditions, and to assist in these tests, a reactor was made available which could be connected between the generator transformer and the station busbars. The additional reactance was equivalent to approximately 50 miles of 132 kV overhead line. With an initial load of 60 MW at 100° rotor angle and the reactor in circuit, tests were made by shorting out the reactor with and without the rotor angle limiter in service. With no limiter the set immediately fell out of step and resulted in the most severe disturbance to the system experienced during the whole series of tests. With the limiter in operation, stability was easily maintained, as shown from the recording of Fig. 8.

Leading MVAr Limit

Completely stable operation was obtained when generating 60 MW, 66 MVAr lead, at a terminal voltage of 11·25 kV. This gave a transmission angle between the direct axis of the machine and the 132 kV station bars of 120°, and represents a steady-state limit well beyond that likely to be required in practice. The addition of ±5% current-compounding caused a variation of ±3° in the absolute stability limit.

Re-synchronising

A further interesting test was to study the ability of the a.v.r. to restore synchronism once pole-slipping had occurred. The test was initiated by switching the machine to hand control with the hand control set at zero field. This resulted in several seconds of pole-slipping after which the machine was restored to a.v.r. control, when it invariably pulled back into step, even on 60 MW governor setting.

The main reason for this satisfactory performance is that during pole-slipping the terminal voltage drops so low that the regulator receives a continuous signal for peak forcing excitation. A powerful resynchronising effect is therefore produced. The addition of the extra series reactor did not affect the performance.

Discussion

From the power system operation point of view, one of the most important features of any regulator must be the practical one of high reliability and ease of maintenance. This is particularly so for the large sets now being commissioned, and for those in the forthcoming nuclear power stations. If system conditions are such that sets are operating in the dynamic stability region, a failure of any a.v.r. component could cause very serious system operating difficulties.

It was for these reasons that the a.v.r. system described was selected, especially the use of magnetic amplifier circuits, as it is easy to well underrate such items as rectifier plates, resistors, etc., so that component failures prove virtually non-existent. Also, the use of three stages has meant that the gain per stage is relatively low so that drifting problems with component ageing are not troublesome. The magnetic amplifiers themselves are also fully static and experience has proved them to be highly reliable. It was, in fact, ten years' trouble-free experience in using magnetic amplifiers in colliery winder control schemes that resulted in the decision to employ these in

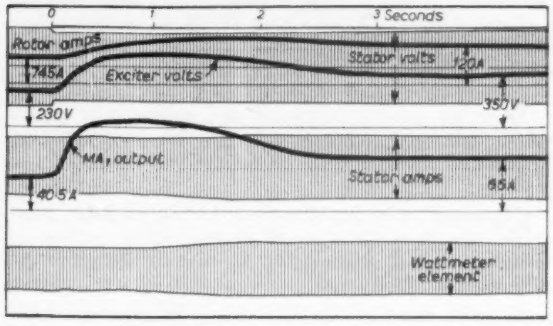


Fig. 6 (a). Transient step increase of regulator voltage setting, causing load angle decrease from 66° to 40°

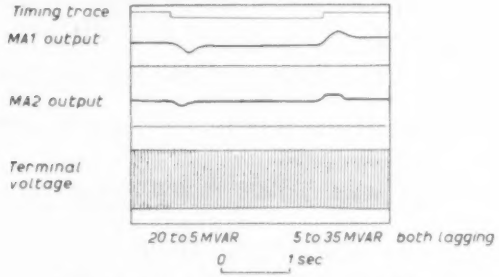


Fig. 6 (c). Step change of excitation at 50 MW

preference to any form of rotating amplifier. The reliability of the hand excitation is also kept to a maximum by ensuring that it is always permanently wired into circuit and cannot be interrupted by any switching except the field breaker or the back-up h.f. alternator supply contactor.

For voltage regulators for small isolated alternators, the usual procedure is to employ push-pull magnetic amplifiers in order to ensure equal positive and negative field forcing, to obtain specified transient performances in each direction and obtain good linear control characteristics of the regulator system. For turbo-alternator control, however, it was decided that there was really no case for negative or bucking excitation of the main exciter, and that in fact it would prove more likely to be an inherent danger instead of an advantage. Only the first stage magnetic amplifier was, therefore, made push-pull for various practical reasons and the two stages feeding the main exciter left one sided. This considerably helped to simplify the regulator, and reference to Figs. 6 and 7 show that the resulting performance was adequate.

The possibility of having a bucking exciter voltage available is dangerous, as under transient conditions there is the hazard that the set can slip only one pole and come into synchronism on reverse excitation. Under these conditions, however, the a.v.r. is working backwards, so that it is unstable and could possibly "lock" on maximum negative excitation giving a very high terminal voltage. This condition is also difficult to clear as a trip to hand excitation can now only cause loss of synchronism.

A very fast boosting of the excitation is, however, very advantageous, this being well illustrated by Fig. 9 showing network analyser swing curves following a system disturbance. The dotted line shows the swing curves for a 120 MW alternator for a fault sequence, and the full line shows the effect of having a fast a.v.r. in circuit. The curves were obtained using the design of regulator described. A regulator having a bucking

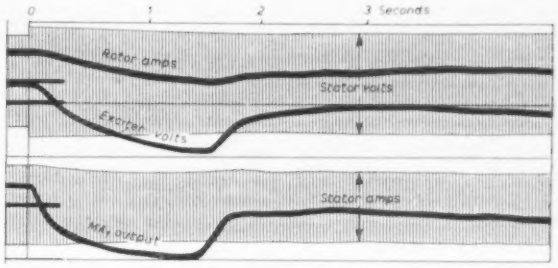


Fig. 6 (b). Transient step decrease of regulator voltage setting

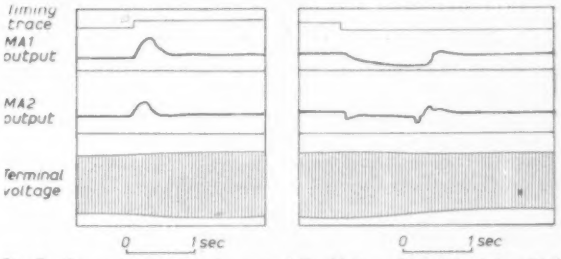


Fig. 7. Open circuit step changes—left, 11·5 to 13·5 kV, right, 13·5 to 11·5 kV

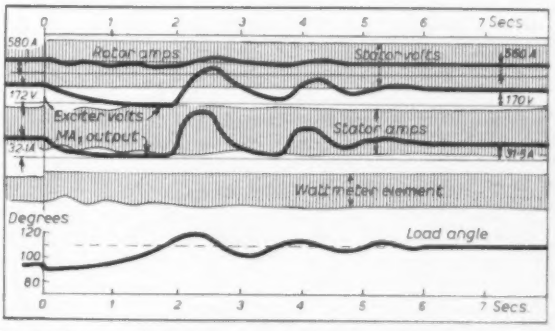


Fig. 8. Rotor angle limiter preventing instability after line switching disturbance. Initial load angle, 95·5°, final load angle, 109·5°, with MVAr change from 31·4 lead to 57·6 lead

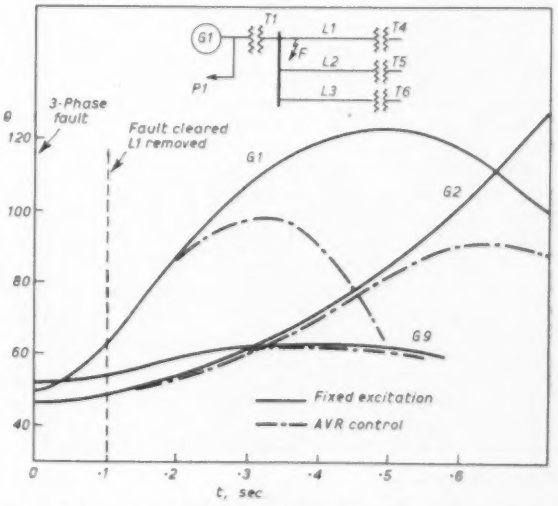


Fig. 9. Swing curves showing effect of CVR-T regulator plus rotor angle limiter for a 120 MW generator

excitation would not give such definite improvement as after fault clearance the rise in terminal voltage could cause full bucking of the regulator thus amplifying the downward swinging portion of the curve and tending to increase the transient swings.

The major advantage of negative excitation would appear to be in obtaining good transient performance from load throw-off tests. This, however, is only of academic interest as any normal regulator is fast enough to prevent the alternator terminal voltage from rising appreciably above the initial jump to the voltage back of transient reactance.

Tests on the rotor angle limiter proved most satisfactory and showed clearly the possibilities of this system. The rotor angle limiter installed in the control room has also proved very useful and more widespread understanding of the significance of the rotor angle should be encouraged. Referring to Fig. 4, simple control of the angle at which the limiter operates is obtained by alteration of resistance R_v as this will alter the value of the bias current i_v. This facilitates the inclusion of automatic alteration to the required limiting angle. The signal e_t can readily be current-compounded in order to give a voltage equivalent to the voltage vector of the system infinite busbar, or alternatively e_t could be the signal direct from any other point of the network. This would then give the alternator overall transmission angle control. A common e_t signal for a widespread group of stations could also be of value in permitting the maximum range of all the machines to be used with full protection against instability. Normal system impedance measuring schemes or suitably alternative signals could also be incorporated without difficulty to adjust individual limiter settings if analysis of the system should show this to be an advantage.

Apart from its use in alternator control, rotor angle control is also of value on synchronous condensers and has been found most successful in practice in taking the fullest possible advantage of the rating of the plant under very low excitation conditions.

The resynchronising tests were most encouraging, as they showed clearly that an excitation system such as that described is capable of immediately synchronising an alternator even under the severest operating conditions that are likely in this country. The absence of bucking excitation is also of assistance here since if the a.v.r. setting is too close to the terminal voltage during pole-slipping a buck and boost excitation could generate violent regulator oscillations.

For special power systems such as occur overseas where a large machine could be coupled to a system by a very long transmission line, there is the possibility that pole-slipping could not be stopped by the voltage regulator characteristics alone, and for these cases some form of integrated voltage, rotor angle and governor control system would be the ideal.

It will be noted that due to the one sided output of the main magnetic amplifier MA_1, the general regulator behaviour is in many ways much the same as that which will be obtained by voltage regulators with a.c. rectifier exciters. The only difference in operation at all will be during pole-slipping when the rotor current will not be permitted to reverse. This does not, however, make any significant difference to the system disturbance already going on, and it is, therefore, fairly certain that from the system performance requirements, a.c. rectifier exciter schemes will be acceptable.

Conclusions

The design of a modern high-speed regulator such as that described requires the combination of three important factors: First, detailed knowledge and application of advanced stability analysis plus access to modern computing aids. Secondly, a detailed knowledge of the characteristics, relative merits, and reliability of many control engineering components. Thirdly, and most important, a full working understanding of the needs of a power system under all conditions, especially for many overseas applications where stability considerations become most important.

It is evident that the design of such a regulator must become the work of a team pooling many sources of experience, this of course being the case for the particular regulator described.

The addition of these regulators to power systems can make a significant contribution to the most economical operation of the system, and ensures the maximum reliability and stability of the system under all conditions.

Acknowledgment

The author wishes to thank the Directors of the General Electric Co. Ltd. for permission to publish this article.

Carbon and Nitrogen in Silicon Iron

CARBON and nitrogen have long been recognised as undesirable impurities in electrical silicon iron, and the general opinion has been that carbon was the worst offender in impairing magnetic properties. Recent work by the British Iron and Steel Research Association has shown that, in fact, it is nitrogen that causes most trouble. This work has been summarised by BISRA (Summary 155).

Difference in the effects of carbon and nitrogen impurities in pure vacuum-melted alloys is shown in the curves of Fig. 1. With commercial alloys somewhat similar results were obtained, except that, particularly in the case of coercive force measured against impurity content, small additions of nitrogen seemed to have little effect. The explanation was found in the small content of titanium in the commercial alloys as an impurity.

There are thought to be two mechanisms by which impurities can affect the magnetic properties of silicon iron: by modifying recrystallisation texture and by forming inclusions which hinder the wall movements of magnetic domains and so increase the hysteresis loss.

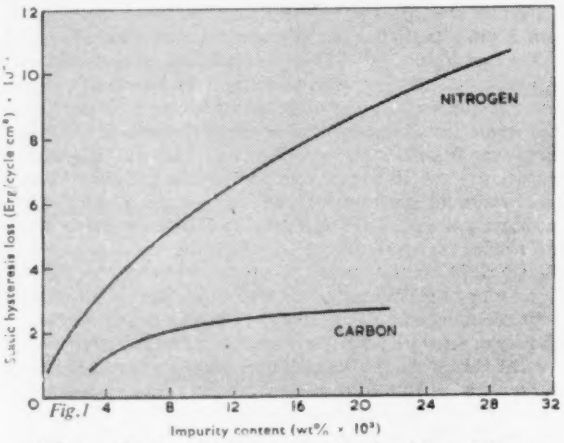


Fig. 1 *Influence of carbon and nitrogen on silicon iron hysteresis loss*

CIGRE 1960

Circuit-breakers

The 1960 session of CIGRE concluded with a discussion on aspects of circuit-breaker performance and testing. Other subjects discussed were the use of sulphur hexafluoride and high pressure air for arc extinction.

Circuit-breakers

WHETHER post-arc conductivity in circuit-breaker is a good or bad influence on fault clearance and the generation of transients has yet to be resolved. However, more information on this aspect of breaker performance was given in three of this year's papers.

Tests carried out at KEMA laboratories with models of air-blast circuit-breakers helped to define the conditions under which post-arc conductivity may affect arc interruption. Two models were used in the tests, which were mainly carried out using a 500 c/s, 200 A r.m.s. circuit although confirmatory tests on these results were obtained at 50 c/s, 2,000 A.

In a model with a throat between electrodes post-arc currents were found only if the natural frequency of the circuit exceeded 100 kc/s. and no measurable current was found at 20 kc/s. The only cause of re-ignition in the latter case was by voltage breakdown of the gap. In a model without a throat between electrodes, post-arc currents up to 5 A were found in both high frequency and power frequency tests circuits. The existence of post-arc current depended on the capacitance in parallel with the electrodes. Increasing this capacitance reduced the value of the post-arc current. However, it was found possible to create conditions favourable to the occurrence of a post-arc current in both models.

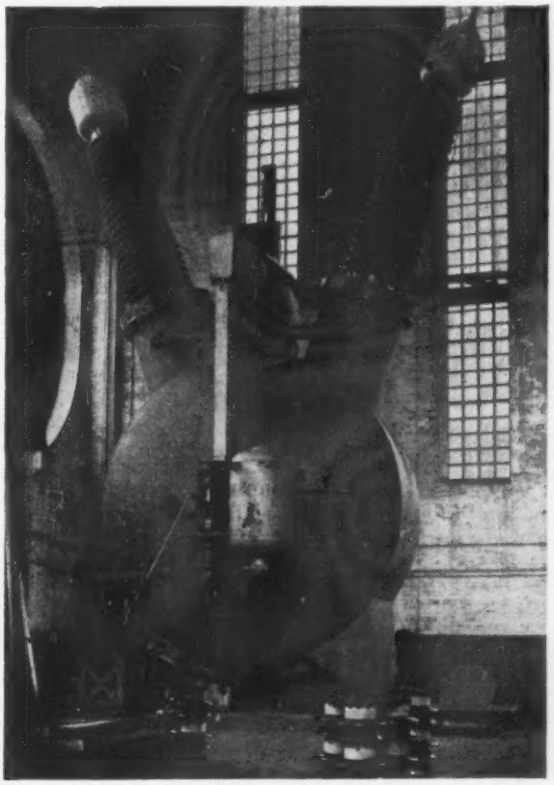
A paper by MESSRS KOPPLIN and SCHMIDT (Germany) described the measurement and effect of post-arc currents in low-oil-content circuit-breakers.

Although very sensitive detecting apparatus was said to have been used in the tests, no evidence of post-arc currents on a 110 kV breaker was found except that due to the capacitance of the break. However, on a 10 kV breaker, a clearly measureable post-arc current appeared immediately following arc extinction. The tests confirmed that both thermal re-ignition and voltage breakdown following arc extinction may occur. If the system voltage is sufficiently high, even small post-arc currents may immediately lead to thermal ignition but at low system voltages a higher residual conductivity may be apparent without thermal re-ignition taking place. Under this condition, a measurable post-arc current will appear.

In this report, and a further report by MESSRS RIEDER and PASSAQUIN, it was concluded that post-arc conditions are still not sufficiently understood for them to be used as a basis for breaker rating, and that tests to destruction were still the only sure way of determining ultimate rupturing capacity. Tests made by the authors of the third report on intensive axial air blast circuit-breakers showed that residual current appeared only for very heavy currents and then only at very high rates of rise of restriking voltage. The breakers were able to withstand large currents of long duration.

Although in general agreement with the findings of the KEMA report, and while expressing the view that it solved satisfactorily the post-arc problem, MR CASSIE (GB) questioned some of the authors' results. One of the reports, he said, also served to emphasise the importance of the pre-zero current period. MR EDE (GB) described work on post-arc conductivity being carried out at Liverpool University.

Good agreement obtained between model tests at 500 c/s and full-scale tests at power frequencies was thought by MR BUTTREY (GB) to be very important for the preparation of synthetic testing techniques. He also referred to increase of post-arc current with short-circuit current amplitude. MR TESZNER (France) called for a purely scientific approach to the study of post-arc phenomena which, he felt, would bring about an improvement in



Insulating the tank of this 330 kV o.c.b. during development tests enabled dangerous depressions of insulating level in the main tank during gas discharge from the interrupter side vents to be detected, while using the normal single phase test circuit

circuit-breaker design techniques. On the other hand, MR HORST (Holland) did not think post-arc currents played an essential role in clearing faults at high frequencies.

Post-arc conductivity had been studied for 20 years said MR MOTT (GB) and although the present papers gave further valuable contributions to an understanding of the problems, he thought it was time full-scale tests on breakers, rather than model tests, were studied more fully. Whether post-arc conductivity was a good or bad influence was not yet resolved, particularly for specific line conditions. It would seem to be useful for clearing short line faults and to suppress current chopping when interrupting magnetising currents, but it resulted in increased arcing time when interrupting short-circuits. Tests should be made at the correct voltage for an interrupter and since post-arc conductivity could not yet be controlled, it must be regarded as one of the evils of circuit interruption. He said that he was becoming more and more suspicious of synthetic tests.

MR AMER (GB) did not think much use could be made of post-arc conductivity for design of oil or air blast breakers, but it may be an important feature in the future design of air-break units, where the arc length was considerable, enabling over-voltages to be restricted. This was supported by Mr Schmidt, who added that more research was necessary. He also took issue with Mr Mott on the value of synthetic tests, maintaining that the factors influencing the post-arc current were exactly the same as in full-scale tests.

Switching Long Lines

An analysis has been made in one of this year's reports by MESSRS WITT and BERGSTROM (Sweden) of the transient voltages likely to be produced when switching capacitive lines with restriking breakers. Tests on systems have shown that although very high transients may result, in general the system configurations used are not conducive to the production of high over-voltage transients. Measurements on one 400 kV line, however, have shown recorded over-voltages of 1,800 kV. Considerable difficulty was encountered in measuring transient over-voltages because of their short duration. The report suggested that, where high over-voltages were present as indicated by functioning of lightning arresters, it would be sufficient to replace any restriking breakers by those of non-restrike type.

Calculation of the magnitude and severity of surges was complicated by the difficulty of predicting exactly the behaviour of circuit-breakers under restrike conditions.

A report by JOSS and LEIMGRUBLER (Switzerland), described the design of a low oil content breaker for a 245 kV system which has been tested up to 300 kV. The breaker was designed to meet the basic requirements that restrikes should be avoided in interrupting capacitive lines since, although tests on system voltages up to 170 kV suggest that restrikes are harmless; for system voltages above 245 kV, prevention of restrikes was essential if damage to transformers and other plant was to be avoided. The circuit-breaker had a high pressure oil pump to force oil into the breaker gap during interruption. By using a two-break construction, it had been possible to increase the speed of the moving parts substantially, enabling the dielectric recovery of the breaker gap to keep ahead of the rate-of-rise-of-restriking voltage. A resistor was shunted across the gaps to ensure uniform voltage distribution. Previous tests had shown that such a resistor could be used to limit the restrike surge voltage produced by a breaker, but to be effective on long lines its resistance would have to be so low that it would raise thermal difficulties in interruption of the resistor current by the breaker.

Tests on this type of breaker were performed at the testing station of the Italian network in Milan. Another Swiss paper suggested a synthetic method for testing high voltage breakers under capacitive switching conditions. The method was claimed to have the advantage of using normal test equipment in a switch-testing station, without the need to install expensive capacitor banks. It was claimed to give an assessment of the maximum rupturing voltage possible for any given type of breaker without restrike occurring.

Some speakers raised objections to the method on the score of its performance under restrike conditions. It was agreed that it was preferable to design breakers to avoid restrikes as was now possible.

Defending the synthetic method of testing MR THALER (Switzerland) said agreement with direct tests had been well maintained during a series of several thousand synthetic tests. The method was economical and had been successfully used on a new series of breakers.

Kilometric Faults

A result of the large increases in power transmitted over high voltage systems was the larger number of short line faults. Known as the kilometric fault, it was characterised by a short-circuit on a high power transmission line at about 1 km from a circuit-breaker causing a very high rate-of-rise-of-restriking voltage. A lucid analysis of this type of fault was given in a report by MR PETITPIERRE (Switzerland). Although with large interconnected systems and a high short-circuit current the natural frequency would normally be low, leading to a low rate-of-rise-of-restriking voltage after interruption, with very large systems, clearing an overhead line fault at a short distance from a breaker superimposed a saw tooth oscillation on the normal network oscillation causing a very high initial rise-of-restriking voltage across the open breaker contacts sufficient to reignite the arc. Tests described in the report suggest that air-blast circuit-breakers are in general able to withstand this type of fault, their performance may, however, be improved by shunting the breaks with relatively low value resistors. The author expressed some doubts whether methods of synthetic testing were able to effectively verify performance of multi-break interrupters with this type of fault. He did not think the design of special breakers, as for instance has been undertaken for interrupting line charging currents, was necessary.

This statement was supported by MR MOTT (GB) who said, in his opinion, the kilometric fault could be dealt with by proper circuit-breaker design. He was doubtful about the extra complications introduced by using low ohmic resistors shunting the breaker gaps and thought attention to design details of the breaker a more profitable line of research to pursue. Doubts about the author's suggestion that the kilometric fault should be the subject of separate tests were expressed by MR ZOETEN (Holland). He thought it too easy to increase the number of cases where special tests were called for.

In conclusion, the general opinion seemed to be that although air-blast circuit-breakers were sensitive to the kilometric fault, they could be designed to meet the condition satisfactorily. One speaker said that low oil content circuit-breakers could be designed to cope with this type of fault with the correct design of jet construction. This type of fault clearly imposed fresh problems on the formulation of test procedure.

Future Trends

The rapid increase in interrupting capacity required of circuit-breakers to meet modern circuit conditions has prompted several lines of research into both improved breaker design and new interrupting media. Two investigations, one in its early stages and one with several versions in operation, were described in reports presented to this year's CIGRE. Research at the Fontenay testing station of E de F into air-blast circuit-breaker operation with pressures ten or 20 times those at present in use have given some useful preliminary information.

Higher operating dielectric pressures require the use of new insulating materials and one of these, stratified epoxide glass, was used in the experimental models tested. Dielectric strengths obtainable in high pressure air at 1,140 lb/sq in. were said to be comparable with those in a vacuum of 10^{-3}mm of mercury. Although the investigation is not yet far advanced some promising results have been obtained.

In the USA further development work on the use of sulphur hexafluoride as an extinguishant culminated last year in the commissioning of a 15,000 MVA 230 kV breaker. Gas stored at 14·5 atmospheres was expelled through three pairs of contacts in series per pole and exhausted to a tank held at three atmospheres pressure. Among the advantages claimed for this type of breaker were: less weight than comparable air-blast breakers, less operational noise and avoidance of difficulties caused by moisture penetration since the breaks are totally enclosed. Intermediate capacity breakers of this type have been in operation since 1956 and load break switches since 1953. Because of the different physical properties of the gas when compared with compressed air, the breaker constructions were considerably different.

One of the advantages of higher pressures, said MR MOTT (GB), was the reduction possible in the number of breaks per phase. However, higher pressures would, in his opinion, call for modified design of blast valves and some effective means of silencing since, in Britain at least, noise of operation had in some instances precluded use of air-blast circuit-breakers.

In the USSR, according to MR GRAINGER, air-blast breakers were being developed for pressures of 570 lb/sq in. with metal chambers containing the interrupters.

The session on circuit-breakers concluded with references to three reports describing testing stations and techniques. MESSRS FRATE and SCUCCATO (Italy) described a novel method of measuring mechanical stresses on breakers while testing under service voltage conditions. The method consisted of converting the mechanical stress signals from strain gauges on the circuit-breaker structure into light beams by transistorised amplifiers, shielded against interference by the breaker action. The light beams were picked up and interpreted by receiving apparatus operating at earth potential.

A report by MR ROXBURGH (GB) outlined improved testing methods developed for proving oil circuit-breakers designed for the 275/300 kV supergrid, rated for capacities up to 15,000 MVA. Finally a Czech report described in some detail the testing facilities at the Bechovice high power testing station.

Geothermal Progress in New Zealand

PROGRESS with building power stations in New Zealand is reviewed in the annual report of the NZ Ministry of Works for the year ended 31 March last; for it is the MoW that in New Zealand is responsible for the constructional side of the major power projects.

Outstanding in the work surveyed is that in the Wairakei geothermal area, where excellent progress is being made after early setbacks. During the year, the production capacity of this natural steam plant was increased by drilling six 8 in. boreholes to depths ranging from 2,090 ft to 2,300 ft. An important experiment conducted during the year was to discharge steam from as many as possible of the existing bores at the same time. The purpose was to check fears that there might be a significant reduction in output when many bores were discharging. The results were reassuring; there should be sufficient steam and hot water available for stage 3 of the Wairakei project, which aggregates 250 MW.

Up to the end of the year, six of the seven machines in the stage 1 scheme had been run, with maximum output of 46 MW. Commissioning of the seventh machine has subsequently brought the total installed capacity to the planned value of 69 MW. Early civil engineering work for stage 2 has been completed.

There is another prospective geothermal site at Waiotapu, and this gave promising results during the year, to the extent that trouble with rapid mineral deposition that had been found with some trial bores was not apparent with others.

The report notes progress with the hydro schemes the Ministry has under construction, and the more important of these are listed below in alphabetical order.

Aratiahia. Three 30 MW sets, initial commissioning 1964. In the design stage, plus some excavation.

Atiamuri. Three 21 MW sets working, a fourth on order.

Aviemore. In the investigational stage. This will probably be the next station near Lake Waitaki after Benmore is completed. Dam site investigations were in hand.

Benmore. New Zealand's largest scheme, 540 MW ultimate; this was well into the initial construction phase. The aim is to divert the Waitaki River soon. A feature of the scheme, which is based on an earth dam, is use of 17 ft 6 in. penstocks of pre-stressed concrete, said to involve the largest combination of pressure and diameter yet attempted in this form of construction.

Maraetai II. 180 MW peak load station, duplicating installation of present station. Excavation work well advanced.

Matahina. Station approved for commissioning in 1965; 72 MW scheme with 200 ft head. Earth dam across mouth of Rangitaiki Gorge.

Meremere. Coal-fired 6 by 30 MW station now operating to capacity, boilers being modified to give better working with local coal.

Ohakuri. Power production from this 4 by 28 MW hydro station expected late this year. Earth dam on Waikato River.

Roxburgh. The second set of four machines (160 MW total) in course of installation. When the station was built, pits were left in the power-house for these machines.

Waipapa. First power from this 50 MW project early in 1961.

Fluorescent street lighting in Maidstone

IT is a regrettable fact that in many towns today there is an unhappy conglomeration of tungsten filament, mercury vapour, sodium and fluorescent street lighting, the result of piecemeal modernisation which often reflects the economic and fashion changes that have been an inevitable feature of post-war civic planning. Maidstone Town Council are to be congratulated on being among the select few who have taken the bull by the horns and have entered on a comprehensive relighting scheme for the whole town and have chosen fluorescent lighting which, though somewhat higher in first cost, involves considerably lower running and maintenance charges. The total scheme, estimated to cost about £100,000, has been divided into four stages covering a period of five years. The first stage has been completed at a cost of £26,000 and the contracts for the second, valued at £27,000, have been issued.

The First Stage

For the first stage, the replacement of tungsten and mercury vapour fittings on the North-South and East-West arterial roads at the centre of the town, on trolley bus routes through the Park Wood housing estate and on bus routes through secondary roads near the town centre, 200 Kuwait (5 ft 80 W) single and twin fittings, 100 Carpenter (3 ft 30 W) and 11 Crawley (2 ft 20 W) have been installed, the former for Group A lighting and the latter for Intermediate and Group B lighting respectively. The fittings have been harmoniously adapted to existing lighting standards wherever possible after removal of the old bracket arms and scroll work. In other cases they have been mounted on the top of power poles, on new steel poles and, in a few cases where the streets were rather narrow, on the walls of buildings.

Siemens-Ediswan "Kuwait" Lanterns at Maidstone

Kuwait lamps are switched by Horstmann timeswitches to provide full illumination from each lantern's three tubes until midnight, reduce to one tube up to 5 a.m. and back to full lighting until dawn. On side roads lights are switched on from dusk to midnight and 5 a.m. to dawn by Sangamo timeswitches.

The second stage will cover Loose Rd to the Borough boundary, Chatham Rd to the north of the town and bus routes through three housing estates.

The relighting plan was originally prepared in 1958/59 by the then Borough Surveyor, Mr S. F. Dixon, and the General Manager of the Transport Department, Mr Kershaw. Fittings and installation were contracted to the Lamps and Lighting Division of AEI who sub-contracted the erection to Messrs Clough Smith and Co., of Crawley. Detailing of the second phase has been in the hands of Mr R. Orrell, who succeeded Mr Dixon as Borough Engineer early this year.

NIGHT "TROTTING" IN N.Z.

A NEW experience for the Wellington New Zealander is "trotting" by floodlight at the remodelled Hutt Park racecourse, which was recently reopened after the installation of a new track and floodlighting by Benjamin "Duoflux" fittings with 1,500 W tungsten filament lamps. It is, of course, winter in New Zealand at this time of the year.

The 4½ furlong 75 ft track is now surfaced with special crushed sandstone, as compared with the old, discarded grass track, which not only makes for faster racing but provides a light background against which the horses and drivers stand out in sharp relief under the lighting. In planning the installation it was important to ensure that the number on the sides of the horses and on the circular discs attached to the harness at the top of the horse's head were clearly distinguishable and that the owner's colours were easily recognisable but, from the spectators' and riders' positions, there must be no glare.

The scheme adopted was to mount the fittings on extended arms stretching out 10 ft over the track from 60 poles spaced 66 ft apart. Except on the bends and home stretch, where poles are sited on both sides, the track is illuminated from a single row of fittings on the inside rail. Since riders tend to cling to the rail, this gives light where it is most required with an economy of fittings.

At the winning post a string of 24 Benjamin deep bowl reflectors with 500 W lamps stretches across the track to provide a high, even level of lighting for the photo-recording of finishes. Duoflux floodlights are also used to illuminate car parking areas, the zones around the totalisators and for the tote boards as well.

Supply for the lighting is derived from a substation which has been erected behind the winning number board opposite to the spectators, and every fourth pole is connected to an emergency diesel electric generating set which is kept running throughout the race meetings to guard against total black-out in the event of a mains failure. Lights in the general public area are also connected to this emergency supply. The total floodlighting load on the track is 102 kW and care has been taken in planning the cables to keep voltage drop on the circuits to a minimum.

The reflectors are of vitreous enamelled steel, particularly suited to the rigorous weather conditions and strong salt-laden winds which are typical in the vicinity and were supplied by Cory Wright and Salmon Ltd., distributors of Benjamin fittings for New Zealand. On the opening night, a record crowd of 14,000 were present and were responsible for an "on course" betting turnover of some £80,000.

Night view of the Wellington Trotting Club showing the excellent illumination round the whole of the track

Economy in energy

FURTHER PAPERS FROM MADRID W.P.C. MEETING

MAKING the most of energy that would otherwise go to waste was a topic of several papers at the recent sectional meeting* of the World Power Conference held in Madrid. A good example of the type of paper presented on this point is that by Messrs N. D. Whitehouse and A. Stotter (English Electric) on the use of waste heat from diesel and dual-fuel engines. Some of the applications they deal with are relatively well established, such as direct heating of buildings or the heating water for generation of process steam. Other ideas are desalination of sea water and the heating of a sludge digester plant in a sewage works. More novel is the study of waste heat for refrigeration purposes in cooling the intake air to the engine.

Refrigeration and Diesels

In a diesel engine, about one-third of the heat in the fuel is rejected in the exhaust gases and one-fifth in the engine cooling water. This heat can be applied through a waste-heat boiler heated by the exhaust gases, and the engine cylinder jackets, to generate steam which can operate a single-stage absorption refrigerator. The refrigerator output is used to cool the intake air.

Calculations suggest that an engine of 566 b.h.p. rating under standard conditions of an 85°F ambient could be uprated to 620 b.h.p. with air from the after-cooler down to 45°F. However, the cost of the refrigeration equipment would be relatively great for a single engine, and checks have suggested it may be as much as £40 for each additional h.p. of output made possible.

Better economics apply where a power station is concerned, especially if the waste-heat can be used primarily for refrigeration for air-conditioning purposes. In such a case, the intake air to the engines may be cooled to increase their total rated load, to meet peak requirements. With a station requiring seven conventional sets, for a peak output that could be met by six sets if refrigeration were used, a saving of some 8% in installation and machinery costs should be possible, with hardly any difference in running costs. If refrigeration is installed for diesel charge air cooling only, a saving of about 3½% in capital cost seems possible, with a slight advantage for refrigerated engines so far as running costs are concerned.

Industrial Generation

More conventional saving of waste energy through combined power and steam generation is discussed in a paper by Prof K. Kopecki (Poland) which deals with parallel running of factory stations with the public supply. After allowing for transmission losses it is estimated that average gross fuel consumption per kWh of delivered electrical power is about 1·34 lb of coal. A rough figure for back-pressure generation is 1·1 lb of coal/kWh. The paper investigates theoretically the limits between which combined steam and power generation are economic.

The paper discusses what should be paid for energy exported from an industrial back-pressure station to the public supply, noting that it is the practice in some countries to pay no more than the equivalent fuel cost for night energy, and 2 to 2½ times this at other times. The argument in these cases is that the guaranteed power from the back-pressure scheme is effectively zero. The comment is made that under these conditions it is normally not worth generating more power than the factory needs. However, Prof Kopecki argues that if there are several industrial power stations generating back-pressure power, then these have a firm capacity during peak load hours ranging up to 50 to 60% of attainable capacity of the stations. For this reason, a power-dependent element should be included in the tariff, which should make provision for differential payments over three time zones.

In power stations, most of the waste heat is carried away in the cooling water; and additional energy is, of course, required to keep the cooling water circulating through the condensers. A paper by Prof F. Roma and a number of other Italian engineers notes introduction of air-cooled condensers in the "Citta di Roma" station of a mining company near Perugia. This burns brown coal of 5,160 B.Th.U./lb calorific value and has two 36 MW sets. No details are given of the condensers, which are claimed to represent "the first large-scale experiment with this kind of condenser," but they are said to have proved quite successful.

At another factory (an oil refinery) mentioned in the same paper, 31 MW condensing sets are in use from which no less than 400 klb/hr of steam is extracted at 720 lb/sq in. for heating, initial steam conditions being 1,720 lb/sq in., 1,000°F. The machines are noted as being of "quite unusual construction" and with novel operating features. Heat consumption ranges from 5,950 to 9,920 B.Th.U./kWh generated, depending on the steam demand.

Solar Energy

Applications of solar energy are discussed in a paper by Dr H. Heywood (principal, Woolwich Polytechnic). He suggests that the economic value of solar heating in semi-tropical climates is well established. The need now is for an effective marketing organisation to promote sales. In temperate climates the economic value is bound to be marginal, and related to any policy about minimising the use of electricity and other high-grade fuels. Based on statistics for sunshine at Kew, there is a clear case for combining solar heating with electrical heating; cost of the solar heater could be recovered in about four years through savings in electricity. In conclusion, Dr Heywood suggests that it would be appropriate for the UK to put more effort into research on solar energy utilisation.

* This is the fourth article reviewing papers presented to this meeting. The previous articles were in the issues of 16 June, 7 July and 28 July.

Supply difficulties in Eire

THE effect of weather on a multiple-fuel supply system is shown up in the report of the Electricity Supply Board of Eire for the year to 31 March, 1960. Owing to the lack of rain up to the end of October last, hydro generation was greatly reduced. This, however, was more than compensated for by the increased rainfall in subsequent months so that for the whole year hydro production was up by 6%. The fine summer weather was ideal for the production of peat and a substantial increase in generation by this fuel was possible. As a result, generation during the year from native resources amounted to 73% total. This is likely to fall in the future, since hydro development in the country is virtually complete and no new resources are available. The extra costs of increasing thermal generation will, therefore, have to be faced.

Financially, the year has not been a good one. Although gross revenue was up by some 7% at £14,780,128, working expenditure showed a greater increase, and with rises in capital charges the deficit has gone up from £98,883 last year to £432,558 on the current account. With a carry forward of £71,000 from last year, there remains a deficiency of £350,000 needing special treatment. With expenditure overtaking the growth in earnings, the board clearly looks to the need for an increase in electricity charges in the near future if it is to make its accounts balance. Particularly will this become necessary with the increasing dependence on thermal power for meeting load growth.

The greatest single factor in the unfavourable results that the board has experienced during the last three years is the unremunerative nature of the rural development programme. Originally, the plans for development had been based on a 50% capital subsidy, which was the minimum considered necessary. This Government subsidy was, however, discontinued, but was reintroduced in 1958 at a time when the board had had to meet £9·5 million capital expenditure which they would otherwise have received as a subsidy. The effect of this has been to add a further £500,000 for interest to the annual accounts. It is stated that even with the 50% subsidy that they are now receiving, new rural development is uneconomic and is a drain on finances. The separation of the board's accounts makes possible an assessment of the position. For the current year, the rural account showed a deficit of no less than £887,689, whereas non-rural supplies led to a surplus of £327,870, the two leaving a working deficit of £559,819 on the year's operations which, with miscellaneous revenue, reduces to the previously mentioned figure for the year. To meet the year's loss, the contingency fund is being reduced from £1·5 million to £1·1 million.

During the year the units sold increased by 9·2% to 1,692 million kWh, including 102 million kWh of night storage heating. The average price per unit fell from 2·14d to 2·09d. A profit of £21,832 was made on the sales of appliances, while a further £9,729 was shown as a surplus on installation contracting.

Units generated and purchased were up by 10·4%, over one million units having been purchased from the Electricity Board of Northern Ireland. The load factor showed a sharp jump to 50·1% from 46·8% in the previous year.

Ice protection for helicopters

SUCH is the danger accompanying the formation of ice on the rotors of helicopters to their safety in flight that it is almost universal practice to "ground" all helicopters under severe icing conditions. Electrical de-icing by the intermittent, cycled passage of current along elements formed by flame-spraying copper-manganese alloy in ordered pattern on to a epoxy-resin bonded fibreglass base cemented to the leading edge of aircraft wings, a process developed by D. Napier and Son under the name of "Spraymat," has proved successful in defeating icing on conventional aircraft. Its application to helicopter rotors is, however, complicated by the necessity of maintaining accurate balance since the blades are part of a rotating assembly affecting the flying qualities of the aircraft. Moreover, the length of the main blades is such that transport difficulties arise when considering the application of the mats direct on to the blades of larger helicopters, such as the Westland Wessex, at the company's Luton factory.

Building up the metallised heating element to a resistance standard

After three years of development work in close collaboration with Westland Aircraft and the Admiralty, Napiers have now perfected a balanced de-icing element which can be attached to the rotating wings of helicopters in conjunction with a cycling switch which effectively causes the ice to be shed within a few seconds of its formation on the surfaces.

On the fibreglass base, shaped to the contour of the leading edge of the blade, the desired pattern of elements is sprayed and subsequently adjusted along its length to the required resistivity by building up or scraping down the element as indicated by a check resistance meter. Although this may sound rather elementary for production it is, in practice, quite economic since the operators who spray the elements on in the first case reach a high standard of skill in putting on the correct thickness.

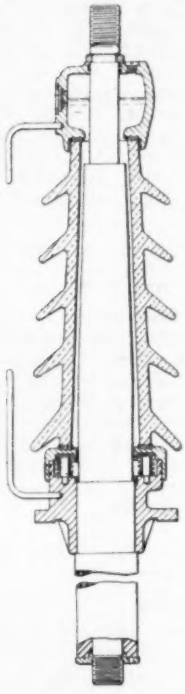
Over this a second fibreglass sheath is applied, care being taken to exclude any air bubbles. For protection on the leading edge against impact with stones or solid objects, a smooth covering of a special epoxide resin impregnated with stainless steel powder is applied to the part nearest the rotor shaft and an electrolytic nickel sheath to the half farthest from the shaft, where the velocity of impact would be higher. The elements are attached to the blades by epoxy resin adhesive and current is cycled by an Austinlite timer. Similar attachments are applied to the tail rotor and it is confidently expected that these developments will enable the Wessex to pass tests which are to be carried out this winter in Canada.

PROGRESS IN PATENTS

SELECTED SPECIFICATIONS

Quick-assembly Bushing

High voltage terminal assemblies, comprising an inner condenser type bushing surrounded by an outer shedded porcelain or glass shrouding with the intervening space filled by an insulating oil, require careful assembly to ensure oil-tightness at the joints without the imposition of excessive compressive stresses on the shrouding. A conventional technique is to use the central conductor as a tensioning member with a nut or screw collar applying the retaining and compressing forces on the shroudings. Oil-tightness is ensured by cementing the ends of the shrouding into metal collars and/or the use of sealing gaskets between the seating faces.



A quickly assembled e.h.t. bushing

Specification 841,722, in the name of the English Electric Company of London, describes an alternative method which simplifies assembly, determines the compressive stress on the shrouding and the tensioning stress on the conductor whilst maintaining oil-tightness of the assembly. The base member, which forms the attachment of the terminal to its associated electrical apparatus, incorporates a piston and cylinder assembly with piston rings to provide an oil-tight seal, the cylinder being in the form of a hollow flanged ring, the upper flange face providing the seating for the lower end of the shrouding from which it is separated by a resilient gasket. The lower face of the flange rests on a number of compression springs providing an upwards thrust on the cylinder and, through it, the shrouding.

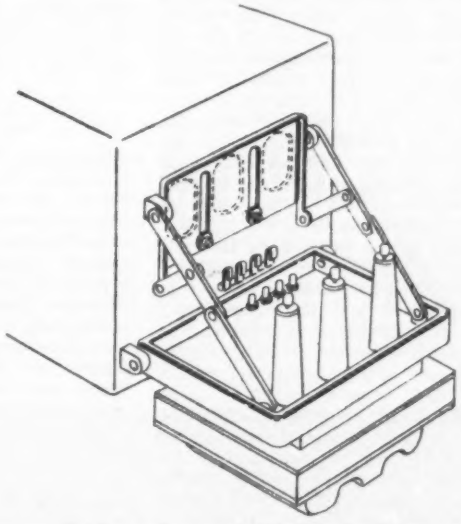
At the upper end, the shrouding terminates in a metal oil-reservoir, from which it is also separated by a gasket, the top of which encircles closely the conductor. This, as in conventional bushings, also forms the tensioning member. The opposing compressive and tensioning forces are provided by forcing the shrouding down against the springs and retaining it in position by a split-ring encircling the conductor at the upper end, above the reservoir, in a groove provided for that purpose.

Thermosensitive Compositions

In specification 696,369, relating to an electric blanket incorporating a control circuit which depends upon the thermosensitive qualities of certain insulating materials, advantage is taken of the high negative thermal coefficient of impedance of nylon, which enables the leakage current between two pilot wires to rise to a value sufficient to operate a protective device at an elevated but safe temperature. In a new specification, 841,604, credited to the same company, the General Electric Company of America, reference is made to other insulating materials which can be brought to an enhanced conductivity at high temperatures by the addition of certain surface-active agents. In particular, stearyldimethylbenzyl ammonium chloride is mentioned as being a preferred additive, but others are listed as well as a number of insulating compositions with which they can be used. The specification also includes a suggested explanation for the phenomenon.

Hinge-mounted P.T.

It is sometimes required to isolate the potential transformer from metal-clad switchgear for maintenance or other purposes and, in specification 842,088, the B.T.H. Co. (now AEI) of London describes a method of isolating an instrument transformer in which it is enclosed within a hinged casing attached to the switchgear with pressure contacts to provide both h.t. and l.t. connections through



A hinged potential transformer for metal-clad switchboards incorporates a protective shutter over the live terminal apertures

apertures in the metal cladding of the switch or busbar-chamber. A shutter, operated by a simple linkage attached to the transformer case, prevents access to the live terminals with the transformer in the isolated position. The preferred method by which this is effected is clearly shown in the appended drawing, which is reproduced above without the reference numbers.

Reproduced by permission of the Controller of H.M. Stationery Office. Copies of specifications may be obtained from the Patent Office (Sales Branch), 25 Southampton Bldgs, W.C.2. Price 3s 6d.

OVERSEAS NEWS

from our correspondents abroad

CANADA

Cable Damage Claim

Quebec Hydro and the Canada Wire and Cable Co. are claiming $885,591 damages from Lloyd's of London and the Institute of London Underwriters. In an action in the Quebec Superior Court they are claiming that sum to cover cost of damages incurred during submarine cable laying operations during 1954. Then, four cables were laid across the St. Lawrence River by H.M.T.S. *Monarch* to carry power from the Quebec Hydro-Electric Commission's Bersimis station to the Gaspé Peninsula. It is stated that the insurance companies have declined to accept responsibility for damage caused, first, when a barge forced out of position by a high tide cut a cable; and, later, by further strong tides and bad weather.

D.C. Experiments Urged

With its great need for tremendous blocks of electric power, the Hydro Electric Power Commission of Ontario should undertake experimental work on transmission of direct current at high voltages. That is the claim of Dr R. L. Hearn who retired in 1956 from the position of general manager of the Commission. He estimates that such experiments would probably cost between $20 million and $50 million. But Mr J. S. Duncan, chairman of the Commission, does not agree with the idea. He considers it would serve no useful purpose to duplicate work going on in Sweden, Russia and Britain on which there is no holdback of information. The Commission is limited by its charter in the amount of expenditure on experimental work, he points out. Mr Duncan himself has only recently returned from Russia where he headed a Canadian power delegation; and he has said that the Commission intends to send technicians to Russia to follow up the group's visit. The Commission has plans for a 460 kV line from the proposed Mattagami River power stations, and in British Columbia there are proposals for a 600 kV line, but there are no plans for d.c. transmission, it is pointed out. For Canada to catch up and solve the technical problems of transmitting 1,000 MW over distances of hundreds of miles at about 1,000 kV, which may be needed in the future, Dr Hearn is suggesting that Canada should start her own experimental d.c. work, with finance provided by the utilities, manufacturers and Governments. The Cross-Channel Cable project of the CEGB will give the Swedes a thorough test of their terminal apparatus, with experience of tying a d.c. system in with two a.c. systems in France and Britain. But the English Electric Co. Ltd. claims to have developed terminal equipment for d.c. equally as good as the Swedish valves, transformers and apparatus, it is stated.

Demands of Smelting

Consolidated Mining and Smelting Co. is applying to the Pacific Northwest power grid for an interconnection to handle future requirements for its Kimberley steel mill. The company has sufficient power supplies from its own resources to operate the iron smelter at Kimberley initially, but expansion now planned will bring a need for additional supplies in the near future. Cominco is scheduled to start operating its first pig-iron furnace this winter, with a capacity of 100 tons/day. Eventually the mill will go up to 500 tons daily. To operate at this capacity, 100,000 h.p. will be required. Currently, Cominco uses about 350,000 h.p. some of which comes from plants on the Kootenay River.

NORWAY

Aluminium Production

Mosjöen Aluminium A/S, the North Norway private company, has a plan to increase production at its Mosal plant from 32,000 tons to 48,000 tons of aluminium a year. Implementation of the plan, estimated to cost £5 million, is dependent upon whether sufficient electricity supplies can be obtained from the State-owned hydro-electric power plants. The Waterways and Electricity Board has indicated that such supplies can probably be made available.

DENMARK

Danish-German Link

A new power cable is to connect Jutland with Germany. This will provide a power link between six Jutland power stations and a station on Funen with the Nordwestdeutscher Kraftwerke in Hamburg. The operating voltage of the line is to be 220 kV. A transforming station is to be built near Aabenraa, in South Jutland, from whence the line will run to the German frontier. This scheme whereby the Danish and German supply organisations will be able to share power resources, is estimated to cost Kr. 6 million, and is scheduled to be in operation later this year.

FRANCE

Aid for Manufacturers

A new organisation has been formed in France, the purpose of which is to make available specialists and technical information for manufacturers of electrical equipment. Title of the organisation is Societe d'Etudes et de Realisations d'Equipments Electriques (SOFRELEC). Partners in the venture are Electricite de France, Credit Lyonnais, the Banque de Paris et des Pays-Bas, the Banque de l'Union Parisienne, the Union Europeene, and Worms and Co.

ISRAEL

Continued Development

The Palestine Electric Corporation are planning to spend between £I45 million and £I50 million during each of the next five years on additional plant to meet the increasing load, we understand. The Corporation's total generating capacity is expected to increase to 710 MW by 1964-65, an increase of 73·2% of the present total of 410 MW.

KENYA

Mombasa Extension

The East African Power and Lighting Co. is extending its power station adjoining Kipevu Docks, Mombasa, by the installation of another 5,000 kW turbo-alternator. Plans are also being prepared for the addition of a 12,500 kW set, probably by 1963, to meet the requirements of the new Changamwe oil refinery.

RHODESIA

Copperbelt's Supplies

Climax of operations of the Rhodesian Congo Border Power Corporation Ltd. last year was reached on 27 Dec. when first supplies from Kariba were taken, bringing into existence a high voltage interconnected network extending nearly 600 miles from the Le Marinel station in the Congo to the Kariba plant on the Zambezi. The Corporation, in its report for 1959, states that its future supply problems had been overcome. With no interruptions to the smooth flow of copper production last year, electricity consumption in the Copperbelt rose by over 22%, to a total of 1,565·3 million units. Apart from supplying its own workings, the Corporation supplies in bulk to several townships. Of its own

power plants, Nchanga continued to be the major source of thermal power during 1959 with a gross output of over 545 million units. The combined output of Mufulira, Rhokana and Roan power plants was 348·1 million units. With supplies from Kariba now firmly established, it is anticipated that generation at the three latter stations will be restricted, for practical purposes, to their waste heat output. At the same time thermal generation at Nchanga will be progressively reduced to a point where the major part of thermal plant on the Copperbelt will be placed on standby duties. Lightning caused 29 outages on the Corporation's 66 kV system—8·3 faults per 100 miles—but a disturbing feature was the high proportion of three-phase faults (eight). The reason for this high incidence is not clear, and is being studied.

Kariba to Rescue

One result of the recent Congo trouble was that tests and adjustments which were to have been made on the Kariba hydro-electric scheme turbines had to be postponed because plants at Le Marinel and Franquis, in the Katanga Province, were temporarily out of action. Normally the latter two plants contribute to supplies to the Copperbelt through the power system of the Rhodesian Congo Border Power Corporation. But when the Belgian system was interrupted, Kariba, which had been supplying the Copperbelt at an average level of around 65 MW, increased its output. The Franquis power station has since re-opened.

INDIA

US Loan

The USA has agreed to finance the Barapani hydro-electric power project in Assam. The project will facilitate use of Assam's important natural resources and help develop the area. Installation of the 27,000 kW power plant and construction of the concrete dam will cost Rs 7·4 crores and will be financed by two US loans. The Development Loan Fund is to provide a $2·5 million (Rs 1·2 crores) loan to cover the foreign exchange costs, while the local costs of Rs 6·2 crores will be met by the sale proceeds of agricultural products supplied to India. Both loans are repayable in Indian currency. The power facilities in Assam at present are inadequate to meet the demand. The Electricity Board operates diesel and hydro-electric plants with a combined capacity of about 13,600 kW, whereas the demand is expected to be 24,110 kW in 1963-64 and 31,500 kW by 1968. The main structure of the Barapani project will be the concrete dam—310 ft high and 580 ft long—on the Umiam river, about 300 miles north east of Calcutta. Two earth dams will also be built to help close the resulting 92,999-acre-foot reservoir. The project also includes 72 miles of double-circuit and 33 miles of single-circuit 66 kV transmission lines, plus swicthyard equipment.

AUSTRALIA

New Collie Station

Tenders are to be called this year for a new steam power station to be built on the Collie coalfield, the Western Australia Minister for Electricity, Mr Watts, has announced. Construction is expected to begin in 1962 and the first generating unit should be operating by 1965. He said the first two sets at Collie would be at least the same size as the 30 MW sets installed at Bunbury power station, but future machines would probably be double that size. Power demand in Western Australia has more than trebled since the State Electricity Commission was established 14 years ago, the Minister said, and it was expected that the demand would go on doubling every seven to ten years. At the present time 60% of all power produced by the Commission was supplied to industrial and commercial users and they must be prepared for that percentage to rise even higher in the years ahead. Siting of the new station on the coalfield also marks a major departure in policy in saving on coal freight, which is 38s a ton between Collie and South Fremantle.

Appointment Wrangle

The general manager of the Sydney County Council, N.S.W., Mr C. E. Ranger, is in the midst of an argument with the council—he has refused to carry out the unanimous recommendation by the council that he rescind the appointment of Mr F. Maguire as assistant general manager. So the council subsequently refused to fix a salary for Mr Maguire, who will remain on his present pay as assistant chief engineer. The controversy began earlier this year when the councillors appointed Mr G. Washington as chief engineer. Mr Ranger favoured Mr Maguire for the position and at the council meeting on 27 June he announced that he had appointed Mr Maguire as assistant general manager. In the ensuing bitter debate Mr Ranger was accused of a "dictatorial attitude," but the latter threatened "to expose things that have happened in the past six months." On 1 July the council deputation asked the Minister for Local Government to reduce Mr Ranger's powers by amending the Gas and Electricity Act, but the Minister suggested that the council should try to settle the dispute. At a subsequent council meeting Mr Ranger maintained that the councillors were discourteous to him by not consulting him on several recent decisions and considered that he had acted within his powers in appointing Mr Maguire. It was pointed out that the councillors had to answer to the public for the sound operation of the council. They had to guarantee that the overhead is not increased too much and that positions filled are justified. Mr Ranger said he could not withdraw Mr Maguire's appointment. The appointment was necessary and he did not make the decision lightly. The Act gave him power to appoint staff, except the three senior statutory officers, and fix salaries without obtaining the approval of the council, Mr Ranger went on. He considered that the councillors were grossly unfair in accusing him of discourtesy, because they had made three important decisions without consulting him. These were the appointments of chief engineer, a salary increase for the administration clerk and the disbandment of the classification board.

NEW ZEALAND

Loco Order

Associated Electrical Industries (N.Z.) Ltd. have received an order from New Zealand Government Railways for 20 sets of power equipment, including diesel engines, for 420 h.p. diesel-electric locomotives. The locomotives are to be built in N.Z. Government Railway workshops, and will be very similar to the 18 locomotives supplied by AEI in 1959. These weigh 41 tons in working order and operate on the 3 ft. 6 in. gauge with a Bo-Bo wheel arrangement. The twin diesel engines will be manufactured by British United Traction Ltd. The locomotives are for shunting service, with a limited amount of running of certain light trains. They have a maximum speed of 40 m.p.h. Delivery is due to commence in June, 1961.

Fluorescent colour change lighting illuminating 80 ft high water jets are part of a beautification scheme recently carried out for the Southwark Brewery, Australia. The brewery buildings themselves are floodlit with fluorescent, sodium, mercury and incandescent lamps. Thorn Electrical planned the lighting

Personalities *in the industry*

Mr H. L. Taylor has been appointed a joint general manager of the Ever Ready Company (Great Britain) with effect from 1 August. **Mr B. G. Phelvin** has been appointed secretary in place of Mr Taylor and **Mr G. L. Grant** has been appointed assistant secretary.

Director of research and education to AEI (Manchester) Ltd., and now president of the IEE, **Sir Willis Jackson,** D.PH., D.SC., M.I.MECH.E., M.I.E.E., F.INST.P., F.R.S., is returning to the Imperial College of Science and Technology—to the chair of Electrical Engineering there. Sir Willis Jackson resigned his chair at the College in 1953 to become director of research and education with Metropolitan-Vickers (now AEI). His new appointment, starting in October, 1961, will come at an important time, for the Department of Electrical Engineering will be moving into a new building now in course of erection and which will permit of a great expansion in the College's effort, particularly on the post-graduate side. He will be joining the strong team of electrical engineers led by **Prof Arnold Tustin,** who has been responsible for the central planning of the new building. Prof Tustin has for some time wished to relinquish the headship of the department, and this will now be taken over by Sir Willis Jackson. Prof Tustin will continue to direct the work of the department in the field of heavy electrical engineering. Other leading members of the department are: **Prof D. Gabor,** F.R.S. (applied electron physics), and **Prof C. Cherry** (telecommunications). Sir Willis Jackson has had wide experience in both education and research—prior to joining Met-Vick he was Professor of Electrical Engineering at Imperial College of Science and Technology from 1946 to 1953, and Professor of Electrotechnics at Manchester from 1938. He has been a member of the Scientific Advisory Council of the Ministry of Supply and the BBC, and has served on numerous organisations concerned with educational matters, including the National Council for Technological Awards, and the University Grants Committee. He was knighted in 1958.

Mr H. G. Whiting, A.M.I.E.E., has been appointed regional engineer, Midland Region of the BBC, in succession to **Mr W. A. Roberts,** M.I.E.E., who leaves the Engineering Division to become administrative officer, Midland Region. Mr Roberts, who has been Midland Regional engineer since 1955, joined the Engineering Division of the BBC in 1937. After service in the Transmitter Operations and Maintenance Department he transferred in 1945 to the Engineering Secretariat and in 1949 he became assistant to the chief engineer. Mr Roberts was a member of the Broadcasting Commission appointed by the Gold Coast (now Ghana) Government in 1953 to advise on the development of broadcasting in that country, and later of the Commission which was appointed to study broadcasting development in Kenya. During 1954 and 1955 he was seconded to H.M. Colonial Office as technical adviser on broadcasting development in the Colonies, in which capacity he has travelled extensively in many parts of the world. Mr Whiting joined the Corporation in 1932 as an engineer in the Transmitter Department. He transferred to the television service in 1936, becoming senior maintenance engineer engaged on development work at Alexandra Palace in 1937. During the war Mr Whiting was a senior maintenance engineer at the BBC's high-power short-wave transmitting station at Rampisham, Dorset. He rejoined the television service in 1946 as a senior maintenance engineer at Alexandra Palace and in 1949 was appointed engineer-in-charge of the Sutton Coldfield television transmitting station. He became engineer-in-charge, television, Birmingham, in 1952.

Managing director of Crypton Equipment Ltd., **Mr S. G. Mundy,** M.I.MECH.E., M.I.E.E., has been elected president of the Garage Equipment Association.

At present deputy director of the Atomic Energy Research Establishment, Harwell, **Dr F. A. Vick,** O.B.E., has been promoted to director of the Establishment as from 1 Sept. **Dr R. Spence,** C.B., F.R.S., at present chief chemist, has been appointed deputy director, and **Mr L. Grainger,** now head of the Metallurgy Division, has been appointed assistant director, with special responsibilities for applied research, as from the same date. **Sir Basil Schonland,** C.B.E., F.R.S., continues as Director of the Research Group, of which AERE, Harwell, is a part. Before joining the AERE in 1959, Dr Vick was Professor of Physics, University College of North Staffordshire from 1950, and vice-principal from 1950 to 1954. Earlier, he was lecturer in physics at Manchester University for five years. Dr Spence has been head of the Establishment's Chemistry Division since Oct., 1947. He was appointed to the Atomic Energy Research Group under Sir John Cockcroft in Montreal in June, 1945, and later moved to Chalk River.

Mr S. H. Oliver has been appointed manager of the Purchasing Department of Castrol Ltd in succession to the late **Mr A. J. Stafford.**

Mr Richard Foxwell, managing director of Wayne Kerr Laboratories Ltd., has been elected to the council of Scientific Instrument Manufacturers' Association. Mr Foxwell, with Mr R. Calvert—then of the BBC Research Department—founded Wayne Kerr in 1945.

Two of the partners in L. G. Mouchel and Partners, **Mr T. H. Bryce** and **Mr B. A. E. Hiley,** who has been with the firm for many years, retired at the end of July, but they have agreed to make their long experience available to the firm as consultants. As from 1 Aug., **Mr L. Dobson** has joined the partnership as Newcastle partner, and will be in charge of the Newcastle office.

Deputy general manager of the Prescot works of British Insulated Callender's Cables Ltd., **Mr L. R. B. Spence,** has retired after 35 years' service with the company. His many colleagues in the company have given him a catamaran sailing boat as a parting gift and at a farewell gathering at Prescot, presided over by Mr R. M. Fairfield, BICC director (home operations), a model of the boat was presented to Mr Spence by **Mr D. W. Aldridge,** deputy chairman of BICC. Mr Spence joined the Mechanics Department of British Insulated Cables Ltd. at Prescot in 1925 and moved to the Wire Mill Department in 1929, where he remained until 1941 when he became a member of the Works Management Department. From 1942 to 1945 he was manager of the Rubber Cables Department at Prescot, producing "D" class cables, this being followed by a three-year period as manager of the Wire Mill Department. In 1948 Mr Spence was appointed manager of the Engineering Production Division, later

Sir Willis Jackson

Dr F. A. Vick

Mr R. Foxwell

serving as Prescot works manager, from 1952 to 1958, when he was appointed deputy general manager (Prescot).

Mr J. H. Cansdale

Mr J. C. Way

Mr J. Rostron

Mr M. W. T. Rees

The Uganda Electricity Board announce that **Mr Erisa Kironde,** B.A.(CANTAB), has been appointed by the board as their deputy chairman for the next year. Mr Kironde, who is resident tutor in the Department of Extra - Mural Studies of Makerere College, is responsible for the Department's work in Eastern Uganda and is at present stationed at Mbale. He was appointed a member of the Electricity Board in Jan., 1957. He is particularly interested in staff matters and training and education schemes and has agreed, at the special request of the board, to give particular attention to these matters, which are of such importance at the present time.

The Midlands Electricity Board announces that **Mr J. G. Kellie,** M.ENG., M.I.E.E., manager of the board's Stafford district, is to retire on 31 Aug. Mr Kellie, who is 61, is a native of Liverpool, and was educated at Christ Church School and University School, Southport, Lancs. After serving an engineering apprenticeship with Cammell Laird and Co. he studied engineering at Liverpool University. His career in the electricity supply industry began in 1923 when he became station shift engineer with the Yorkshire Electric Power Co., two years later being promoted to assistant distribution engineer. In 1928, Mr Kellie moved to Norwich as district engineer in the Corporation electricity supply undertaking, leaving this appointment in 1934 to become chief assistant electrical engineer with the Corporation of Ealing. In 1937 Mr Kellie went to Stafford as engineer and manager of the Corporation electricity undertaking, serving in this capacity until the nationalisation of the industry in 1948, when he was appointed manager of the Stafford district of the board, which was enlarged in 1959 to include Stone. Between 1942 and 1949 Mr Kellie was hon. secretary of the Central England Centre of the Association of Municipal and Electrical Engineers, also serving on the Association's national executive for six years during the war period. One of his last tasks before retirement will be to vacate the office he has occupied in Gaolgate St, Stafford, for 22 years, to supervise the move of his staff to new District headquarters now nearing completion in Brunswick Terr, Stafford.

Dr R. L. Smith-Rose, C.B.E., has been appointed chairman of the Post Office Frequency Advisory Committee. He replaces **Sir Lawrence Bragg** who has resigned because of commitments. Dr Smith-Rose is retiring from the Civil Service in Sept. and his new appointment takes effect from that date.

Mr C. H. Hughes has been appointed a technical director of Bennis Combustion.

Several major appointments in the Traction Division of Associated Electrical Industries Ltd. are now announced. **Mr J. H. Cansdale,** M.I.E.E., M.I.LOCO.E., becomes sales manager of the Division; **Mr J. C. Way,** A.M.I.E.E., A.M.I.LOCO.E., is deputy sales manager; and **Mr J. Rostron,** M.I.LOCO.E., becomes assistant sales manager. Other appointments since the formation of the Traction Division include **Mr M. W. T. Rees,** B.SC., A.M.I.E.E., M.I.MAR.E., M.I.LOCO.E., as chief engineer, Traction Projects Dept., Trafford Park, in addition to his previous position as chief engineer, Traction Dept., Rugby; **Mr E. T. Bostock,** B.ENG., A.M.I.E.E., assistant chief engineer, Traction Projects Dept., Manchester; **Mr J. Woodhouse,** assistant chief engineer, Railway Signals Dept.; **Mr D. C. Webb,** A.M.I.E.E., M.I.R.S.E., assistant sales manager, Railways Signals Dept.; **Mr J. O. Sims,** B.SC.(HONS.), A.C.G.I., sales manager, Traction Dept., London; **Mr G. A. Ashton,** A.M.I.E.E., M.I.LOCO.E., assistant sales manager, Traction Dept., London; **Mr D. W. Evans,** A.M.I.E.E., assistant sales manager, Traction Dept., Rugby; and **Mr J. L. Morgan,** A.M.I.E.E., assistant chief engineer, Traction Motor Dept., Sheffield. Mr Cansdale joined the B.T.H. Traction Dept. in 1936 as a commercial engineer, but four years later was seconded to the Rugby works staff to take charge of a radar production section. In 1944 he returned to Traction Dept., being appointed deputy manager in April, 1946. On the formation of AEI Traction Division he became Divisional Executive Member (Rugby) and, in addition, was appointed sales manager, Traction Dept., Rugby, in July, 1959. Mr Way joined M-V as a college apprentice at the Sheffield works. Subsequently he moved to Trafford Park, becoming a senior sales engineer in Traction Sales Dept., and in 1947 he joined the M-V Traction Bureau in London. In 1951 he was appointed assistant to manager, Traction Sales, and became sales manager, Traction Dept., in January, 1953. Mr Rostron had considerable railway experience before joining M-V in 1946 in the Traction Sales Dept. He was appointed assistant sales manager of that department in April, 1957. Mr Rees served his apprenticeship with B.T.H. Among his subsequent special assignments was responsibility for the design and production of the Admiralty electric torpedo, and in 1947 a special study in America of traction developments. Following six years in the Marine Dept., where he was assistant manager, he transferred to the B.T.H. Traction Dept. in 1955 as assistant manager in charge of project engineering. In 1959, following the formation of AEI Traction Division, he was appointed chief engineer, Traction Dept., Rugby.

Concerning our note last week on the appointment of **Mr A. G. Milne** as Bristol district manager to the South Western Electricity Board, in which it was inferred that the position of adviser to the Bristol and Somerset groups was being discontinued, we are now told by the board that the latter post has not yet been filled—it is not being discontinued.

After over 25 years' service with Rowlands Electrical Accessories Ltd., **Mr H. Hinton,** special head office sales representative, retired at the end of July. **Mr H. B. Olive** has now been apointed sales manager and is responsible for the home sales organisation. **Mr G. Sidney Close,** general manager (head office), will continue to control the Export Sales Department of the company.

Mr G. E. Smith, director of production for the Perkins group, is relinquishing that appointment on 12 Sept. to join the Hamworthy Engineering Co. Ltd. as assistant managing director.

OBITUARY

Mr J. Sim, general manager of Westool Ltd., died on 25 July, aged 48. He received his engineering training with Vickers - Armstrongs Ltd., and was general manager of Vickers Eastern Ltd., who sold and serviced Vickers Group products in South East Asia, until 1951, when he returned to England to become sales manager of Oliver Pell Control Ltd. Mr Sim joined Westool Ltd. as general manager in Jan., 1959.

Mr G. N. Haden, O.B.E., for many years chairman of G. N. Haden and Son Ltd., died on 30 July.

(**Denotes revision to the "Electricity Supply Handbook, 1960."*)

BRITISH STANDARDS

Glossary of Terms used in Telecommunication and Electronics. *BS 204 : 1960. Price 35s.* Probably no branch of the electrical field has seen such an exceptional expansion as that covered by telecommunications and electronics, nor is there one in which the terminology is so perpetually increasing. In the third revision of this invaluable reference work since it first appeared 36 years ago, a host of new terms introduced since the second revision was published in 1943 now appear with a succinct definition in each case. Some idea of the expansion can be gauged from the fact that the second revision contained 86 pages; the latest extends over 291, both excluding the excellent and indispensable index.

A new system of classification is employed breaking the standard into eight main sections—General, Telecommunication Components, Telecommunication Circuits, Radio Terminal Equipment, Propagation and Media, Classification of Radio Waves and Transmissions, Services, and Inductive Co-ordination—each of which is broken down into a number of subsections.

So if you are not familiar with such terms as Companding, Quantization, Logatom, Coma, Wobbulation and Varioplex, this is for you.

High Intensity Elevated Runway Lighting Fittings. *BS 3224 : 1960. Price 4s.* When revising BS 1332, which deals with civil land aerodrome lighting, it was realised that no standard existed for the related lighting fittings and equipment. BS 3224 now caters for that need. It deals with runway lighting fittings and lamps for 50 V r.m.s. supplies and specifies the light distribution, uniformity of intensity in any direction, the mechanical requirements and construction of fittings designed for this duty.

Medical Treatment Lamps. *BS 3232 : 1960. Price 5s.* A new publication, this standard covers the mechanical and electrical requirements of infra-red, radiant heat and ultra-violet medical treatment lamps for safe operation in hospitals and the home.

Resistivity of Metallic Electrical Conductor Materials. *BS 3239 : 1960. Price 5s.* A new standard prescribing a method for determining resistance and resistivity of metallic conductor materials, with an appendix giving a list of temperature coefficients, another for correction factors with temperature variation above or below 20°C for copper, cadmium-copper and aluminium and a third on the correction of resistance and resistivity values with temperature.

Industrial Protective Gloves. *BS 1651 : 1960. Price 10s.* A revision of the 1950 standard with later amendments, this retains the original objective of reducing the wide number of protective gloves in production to 17 basic types according to 16 classes of industrial hazard. A seventeenth, Class R, dealing with electric shock, is covered by BS 697, also recently revised. The title has been changed from the original, "Industrial Safety Gloves," because of possible misunderstanding arising from the use of the word "safety," and Type 5 in the 1950 edition has now been discarded because of limited use without, however, renumbering of the remaining types. Some designations—"Clute," "Gunn," "Montpelier"—are unfamiliar here, but have been included in the interests of international uniformity. Although not specifically concerned with gloves for electrical purposes, the standard is of interest in many fields allied to electrical industry, such as arc-welding, electrolytic processes, etc.

The Reception of Sound and Television Broadcasting. *CP 327.201 (1960). Price 12s 6d.* A revision of the 1951 Code of Practice issued under the title of "Broadcast Reception: Sound and Television by Radio," this now takes into consideration the requirements of aerial systems for f.m. sound broadcasting, Band III television and Band II v.h.f. transmissions. There has also been a review of recommendations in relation to Band I television and long, medium and short wave broadcasting to bring them into line with recent technical progress. This is an invaluable reference work for all who are concerned with the erection of receiving aerials for broadcast transmissions and for those who are operating, or intending to operate, relay services.

Rotating Electrical Machines for Use in Ships. *BS 2949 : 1960. Price 8s 6d.* A new specification prepared at the request of the IEE committee on regulations for electrical equipment for ships, this deals with motors from one h.p. upwards and a.c. and d.c. generators from 0·75 kW or 0·75 kVA upwards. Eleven sections are included. The first covers the usual scope and definitions, of which there are no less than 21. Under classification, ships are divided into two groups: ocean going and others, followed by four service conditions and 22 letter symbols assigned to 21 types of machines. Phase and wave-form, rating and constructional requirements are covered by five sections with a further section on performance. Tests, tolerances and information to appear on the number plate complete the sections and there are two appendices, one on heat measurement and the second on information to be given with inquiries and orders. This is a workmanlike specification of value to all connected with the design and supply of motors for shipboard.

Rotating Electrical Machines for use on Road and Rail Vehicles. *BS 173 : 1960. Price 10s.* A new edition of the 1941 second revision of BS 173, "Traction Motors and Associated Rotating Electrical Machines," this has now been retitled and brought into line with the IEC publications Nos. 48 (Rules for Electric Traction Motors), 101 (Rules for Auxiliary Machines on Motor Vehicles) and 102 (Rules for the Electric Transmission of Vehicles with Diesel Engines). The specification reflects the progress which has been made in industry over the past 19 years and covers the requirements and performances of motors and generators which form part of the equipment of electrically propelled rail and road vehicles, including those in use in mines. Battery operated equipment for delivery and industrial trucks is not included but remains as a separate specification, BS 1727.

Filler Rods and Wires for Inert-gas Arc Welding. Pt. 2. *BS 2901 : Pt. 2 : 1960. Price 7s 6d.* This new publication specifies the requirements for 35 different types of ferrous and non-ferrous round wires used in gas-shielded metal-arc welding and normally supplied on reels. It is the second of a comprehensive range of specifications for filler rods and wires which are being prepared under the supervision of the Welding Industry Standards Committee and is in two main sections. The first deals with the general clauses covering such matters as standardised diameters, tolerances, condition of wire, reel weights and sizes, reeling conditions and marking. The second breaks the range of wires into four groups and lays down the specific requirements for each. The groups are A, covering steel wires; C, covering copper and alloy wires; G and NG, covering aluminium and aluminium alloy wires; and NA, covering nickel and nickel alloy wires. There is a useful short appendix relating to the welding of aluminium-magnesium and aluminium-magnesium-silicon alloys.

Graphical Symbols for Components of Servo-Mechanisms. *BS 3238 : Pt. 1 : 1960. Price 4s 6d.* The first part of a standard to serve as a companion volume to BS 1535 : Section 5, this lists about 25 new symbols used in transductor and magnetic amplifier technology which are recommended as suitable for standardisation. An appendix gives recommendations as to the conventions to be adopted to indicate polarity or direction of flow, the first being as indicated in BS 822 and the second the internationally recognised "dot" convention. At the request of the industry this short standard has been published in advance of the more comprehensive work, Part 2, containing symbols for remaining servo-mechanism components, though in preparation, not having reached the publication stage.

Preparing for Oldbury

HYDRAULICS RESEARCH FOR NUCLEAR STATIONS

INVESTIGATION of cooling water requirements for Oldbury nuclear station and how they will be influenced by tidal flow has formed one of the major investigations undertaken during the past year by the Hydraulics Research Station and described in the annual report published last week.

A model of the Severn estuary was completed in June last year. The model represents the course of the Severn from English Stones, the site of Oldbury nuclear station, to the Severn railway bridge. It will be used to study abstraction and return of cooling water for the station condensers. So far, a number of proving tests have been satisfactorily made on the model to confirm that tidal conditions are accurately represented. The tidal range of the estuary is 40 ft and the nature of the existing low water channels makes design of the cooling water system extremely difficult. At Oldbury, tests have shown that construction of a reservoir on the river bed, to retain sufficient water to meet the station cooling water needs until the following high tide, would be practicable. The reservoir would be submerged at half-tide.

A probable difficulty was silting up of the reservoir due to the reduced flow velocity of the river. However, tests both on the model and on a small dam built in the river itself have shown that sufficient velocity is maintained to sweep away silt deposited.

Investigations on the model of cooling water recirculation discharged from Oldbury and Berkeley, and probable temperature rise of the estuary water are also being undertaken. These require development of a heating system for use with the model to maintain a water temperature of 15°F ±0·1°F above ambient temperature. A control system is being designed to mix hot and cold water by servo-operated valves, controlled by a special thermistor bridge circuit located in the water-mixing chamber. Thermistors will also be used to measure the model estuary temperatures.

Dungeness Study

Hydraulic problems of a different nature have arisen at the Dungeness site. Here, the problem is to assess littoral drift, that is, movement of shore material along the coast. This will be an extension of investigations at Deal and Rye. Tracers are used which fluoresce under ultra-violet light. Several tracers have been tried but the most successful so far is a compound named Rhodamine B. At Deal, every week since 1 April, one hundredweight of fluorescent pebbles have been dumped on the beach. Their movement is traced along the beach at intervals.

Last year the report referred to an investigation of vortices forming above the water intakes at the pumped-storage station under construction at Ffestiniog. This work has continued during the year with construction of a larger model representing more accurately reservoir conditions.

The modified design of water intakes developed at the station shows complete freedom from formation of open vortices. Fitting perforated baffles between the power station face and pillars carrying the pump screen-guides was found to further reduce the risk of air entrainment.

Difficulties encountered at Stella South power station, caused by sudden choking of the water intakes by leaves drawn up from the river bed, have been successfully solved. In the study, a model was used, with Perspex tracers to represent movements of organic particles in the river. A similar investigation was also made to examine silting of the ash dock at the station.

The work of the Hydraulics Research Station entails development of special techniques. A digital tide recorder has been devised for water levels. Readings are typed at two-second intervals, obtained from five measuring points. The level indicators are potentiometers, 1 ft in length, with slides moved by a probe following changes in water level to within 0·001 ft. Long time-changes in model configurations can be examined by a time-lapse ciné-camera. Exposures are made at each low tide. By projecting the film at normal speed, the time scale is shortened many thousand times and the changes in the model can be more easily followed.

Apart from the work described, many investigations have been made during the year on flow in river estuaries, including the Thames and Mersey, and improvement of docks in many parts of the world.

FUEL STATISTICS FOR 1959

COMPREHENSIVE statistics of the coal, gas, electricity and petroleum industries are contained in the 1959 statistical digest published last week by the Ministry of Power. Information about imports and exports of crude petroleum and products is included for the first time. In the electrical section is given an analysis of electricity sent out and output capacity of stations in relation to plant load factor. 6·9% of total generating capacity has a load factor exceeding 75% and generates 13·2% of the electricity sent out. Over 90% of the units sent out are generated by plant with a load factor exceeding 25% and comprising over 73% of the total output capacity.

The coal distribution analysis shows clearly the part played by power stations in using poorer quality coal. 93·6% of the 43·5 million tons total consumption consisted of treated or untreated slacks and small. It is also noteworthy that since 1950 the electrical supply industry's share in total coal consumption in the UK has risen from 15·8% to 23·5%.

Electricity available for consumption and produced by industrial undertakings was 12,744 million units or 12·5% of that generated for public supply. The lion's share of industrial generation was 4,202 million units by the chemical industry with the paper and steel industries tying for second and third place with nearly 2,300 million units.

The report analyses electricity sales according to area and use and also contains a breakdown of the nature of work done by persons in generating, transmission, distribution and research as well as legal and other staff.

for the electrical trade

Commercial freezer-'fridge

LEC's latest contribution to the commercial freezer-refrigerator field is the "Twelve-six" dual temperature model. Its upper section of 12 cu ft capacity performs the normal refrigeration function and provides the usual sliding inner shelves, tall bottle rack and dairy produce compartments. The lower part of the cabinet is the freezer and has its own door. Its 6 cu ft interior is fitted with sliding baskets and will maintain about 200 lb of frozen food for long periods. "Twelve-six" costs £179 10s and that includes a £10 service fee. *Lec Refrigeration Ltd., Bognor Regis.*

New type noiseless fan heater

A 2 kW fan heater, among the first in this country to employ a tangential fan, has been produced by Ekco. The advantage of this type of fan, which for some time has been popular in Germany, is that it forces air outwards over a considerably wider area than the conventional type, its turbine blades giving effective heat distribution at a slower speed, and consequentially with less noise.

It may be switched down to half-heat and the heat can, of course, be turned off altogether if the fan alone is required. A safety cut-out device is incorporated. Designed for floor or wall mounting, the casing is attractively shaped and finished in beige stove enamel with a gold grille. The tubular stand, which holds the case in a vertical swivel position, may be used to suspend the heater from a wall bracket. The new tangential fan heater is 11½ in. long by about 10 in. in height and depth. It will be available during the forthcoming season selling at £11 15s, tax paid. *E. K. Cole, Southend-on-Sea, Essex.*

Variable heat fan

A 2,000 W fan heater with widely variable thermostat has recently been introduced by GEC. It is of a rounded-edged free-standing design with an illuminated grille acting as a pilot light and driven by an induction motor to avoid interference with radio reception. Finished in red and cream, the new heater, DM 242, is priced £9 17s 6d, tax paid. *General Electric Co., Magnet Hse, Kingsway, W.C.2.*

Printed element warming plate

GEC use a printed heat circuit in their new warming plate. The circuit is sprayed on to the underside of a plate of toughened glass mounted in chrome-brass side channels. It has Bakelite end pieces and legs. The plates reach and maintain a temperature of 200°F, a red pilot light indicating correct operation. The circuit is distributed to give even temperature to 1°F variation. There are two models, one 18 in. long with a 200 W rating and a 30 in. model at 350 W. Width in both cases is 9 in. Prices: D5677, £6 19s 6d; D5678, £12 12s. Warming plates are not subject to purchase tax. *General Electric Co., Magnet Hse, Kingsway, W.C.2.*

TRADE PUBLICATIONS

BULGIN.—News Bulletin, Vol. 3, No. 31, 1960, from A. F. Bulgin and Co., radio and electronic components manufacturers, By-pass Rd, Barking, Essex.

WILD-BARFIELD.—Technical pamphlet on shaker-hearth electric furnaces for continuous controlled hardening. Technical booklet on gas carburising and carbo-nitriding processes. Leaflet describing 2¼ kW induction heating equipment. Brochure giving technical details of laboratory muffles and small furnaces. Wild-Barfield Electric Furnaces, Otterspool Way, Watford By-pass, Watford.

FORAGER MINOR.—Leaflet describing new battery electric fork-lift truck from A. Hirst and Son, Crescent Wks, Meadow La, Dewsbury.

Two-speed intake/extractor fan

A REVERSIBLE extractor fan has been added to the "Coolerway" range. The new model "De Luxe" sells complete with a smart control unit giving two speeds for both intake and extraction operation. This fan has the smooth lines and pleasing finish of the earlier "Royal" model, described on this page on 5 May. It is supplied with 4-core cable for connecting with the control box and priced £10 19s 6d without purchase tax. *Metway Electrical Industries, Metway Wks, Canning St, Brighton 7.*

New Electrolux cleaner

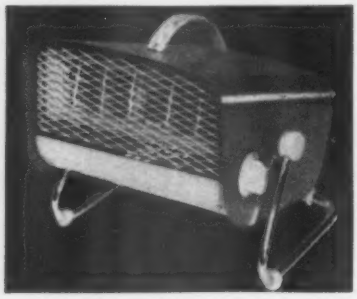
ON this page in last week's issue, the latest Electrolux vacuum cleaner was referred to as No. 65. The appliance is actually Electrolux 64.

Ekco blanket improvement

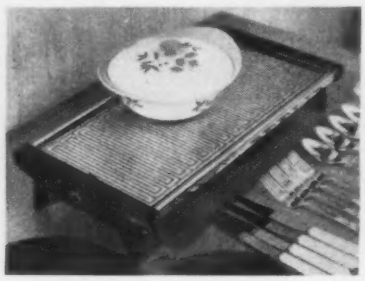
EKCO's range of electric blankets now boasts a room thermostat heat compensator, "Ekcostat." This device, which is dial controlled, can be bought at £1 16s for fitting to an existing blanket. The new range, "Warm-glow," consists of last season's single-heat models, some of which remain unchanged, and includes a double-bed version with two "Ekcostats" for independent heating control of each half. Colours available: blue, rose, peach and green. The prices, tax paid, range from £3 7s 11d (the cheapest one-heat model) to £13 16s 2d. *E. K. Cole, 5 Vigo St, W.1.*

Panel mount fire

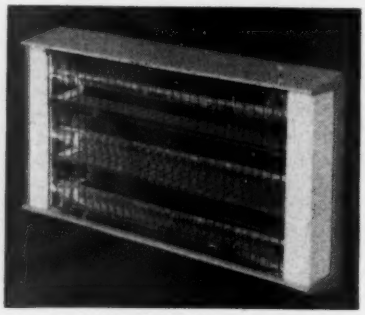
A NEW design of "Supersil" infra-red heaters has been originated with the aim of providing a type of fire ideal for in-building in a room with no existing fireplace. Intended for wall-panel mounting, the new fire consists of the familiar Falks arrangement of three long silica-sheath elements in parallel reflectors with independent switching. The case is straight edged and only a few inches deep with the barest decoration of red/ivory or grey/ivory combinations. Elements have ratings of 750 W each, making a substantial total of 2¼ kW. Price £13 19s 11d, tax paid. "Formica" mounting panels can be supplied. The new fire will be available in early Sept. *Falk Stadelmann and Co., 91 Farringdon Rd, E.C.1.*



Ekco's new heater uses a quiet tangential fan. £11 15s, tax paid



A printed circuit warming plate by G.E.C. £12 12s



The "Supersil" 2¼ kW panel heater from Falks, available September, £13 19s 11d

equipment for industry

100 A heavy-duty terminal block

IN accordance with the modern trend for reducing sizes of components, ElRemCo have recently introduced a heavy-duty terminal block suitable for 100 A at voltages not exceeding 650 V. This two-way block is formed from high quality plastics and has $\frac{7}{16}$ in. nickel plated brass terminals linked by a $\frac{3}{4}$ in. by $\frac{1}{4}$ in. nickel plated copper strip. Fixing is by a 2BA inserts in the base. The blocks have been tested for breakdown as 6 kV rms. Overall dimensions of the type TER terminal block are $2\frac{1}{8}$ in. by $2\frac{1}{4}$ in. by $1\frac{1}{4}$ in. high. *Electrical Remote Control Co. Ltd., ElRemCo Wks, Harlow New Town, Essex.*

Capacitor weld controller

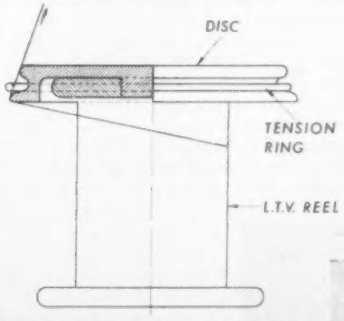
WELDING small diameter wires and thin sheets of high conductivity metals by using a capacitor discharge weld controller recently introduced is claimed to have several advantages. Extremely short weld times varying from 3 to 15 milliseconds are possible with precise control of weld power; a combination of features said to ensure strong uniform welds without discoloration or deformation. Two versions of the stored capacitor weld controller are available: type C.D.1 with a 65 W/second rating and C.D.2 with a 125 W/second rating. Output may be from 100 to 500 V at peak currents of up to 4·2 kA. A valuable advantage of these controllers is their ability to use an ordinary 5 A wiring installation, since the maximum current demand at 240 V does not exceed 1 A. The controller is housed in a robust sheet-steel case with easily accessible components, and plug-in construction has been used for the more important of these. The output of a unit is stabilised for a ±10% mains variation, and for the welding of very fine gauges of wire, a special transformer permitting a high discharge rate is available. *Hirst Electronics Ltd., Gatwick Rd, Crawley, Sussex.*

Timing and control problems

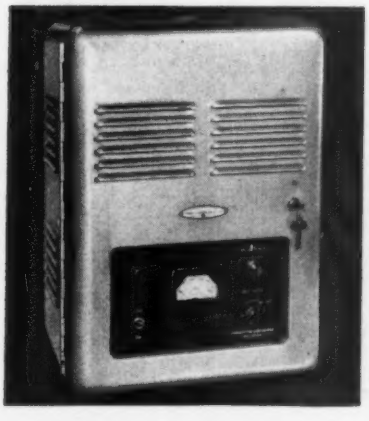
IT is familiar knowledge that new industrial developments frequently present timing and control problems, seemingly complicated and not readily soluble without developing special and costly equipment. Often, however, an expert can reduce the problems to simple elements using readily obtainable components. Such a service is now being offered, claimed to enable non-standard timing and control equipment to be supplied quickly and at relatively little cost. *Equipment and Services, Bush Hse, Bush Fair, Harlow, Essex.*

De-reeling snags overcome

DIFFICULTIES encountered in de-reeling at high speed wire from traverse wheels, such as falling turns, "ballooning" and snarling, are claimed to be avoided by a very simple device recently introduced. It consists of a precision machined ring held in a metal disc which fits on the end face of the reel to be unwound. Taking the wire through the gap between the ring and disc applies sufficient tension during acceleration and deceleration to prevent any snags occurring. Known as the "Biflaker," this simple device is designed for 60 lb wire reels in sizes from 0·0044 to 0·0124 in. diameter. *BICC, 21 Bloomsbury St, W.C.1.*



The "Biflaker," a simple wire tensioning arrangement devised by BICC to overcome wire tangling during de-reeling



A neat, robust case houses the Hirst Electronic capacitor weld controller. The controller is claimed to be particularly suitable for welding fine wire and thin sheet

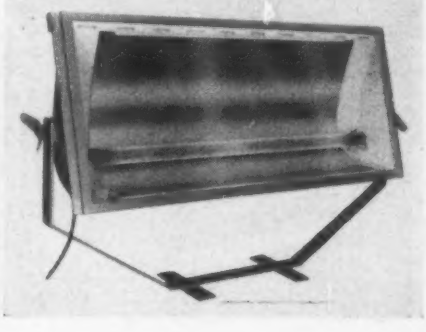
Controlling temperature

AN unusual system of electrical heating control has been introduced with several other new products by Honeywell Controls. The "Weatherstation" controls heating in up to 10 zones through silent switching relays rated up to 8 kW. Control is effected by equipment including temperature and humidity gauges, outdoor temperature gauge, barometer and an electric clock. For situations where accurate temperature control is required the "Versa-tran" fully transistorised printed circuit amplifier is claimed to control temperatures between −60° and +500°F with differential of 1·5°F, or as small as 0·3°F on the more accurate versions. The temperature sensing element used is a thermistor which may be sited 300 ft from the "Versa-tran" relay unit.

Said to be particularly suitable for control of radiant panel heating, strip heating and underfloor heating is a compact hydraulically operated thermostat designed for wall mounting. The thermostat projection from a wall is less than 1 in. and its contacts are suitable for a resistive load of 22 A at 230 V. For industrial heating control, the company have also introduced mineral-insulated thermocouples with sheath diameters of 0·122 in. and 0·06 in. The two new materials, chromel/alumel and T1/T2 have resistances of 1·54 and 6·45 ohms total for a wire pair per ft run respectively. *Honeywell Controls Ltd., Greenford, Middlesex.*

200 W sodium floodlight

FULL advantage of the high efficiency of the 200 W linear sodium lamps introduced last year can be obtained by housing them in a specially designed floodlight. This floodlight, designed for applications where a wide beam is required, has a spectacular parabolic asymmetric reflector of electro-brightened aluminium and a heavy welded sheet-steel body. The lamp is held by a fixed bi-pin holder at one end and a floating holder at the other to ensure that it remains in the correct focal position. The reflector is protected by a toughened clear



This AEI floodlight is specially designed to make full use of the 200 W linear sodium high luminous efficiency lamp for lighting buildings and other large areas

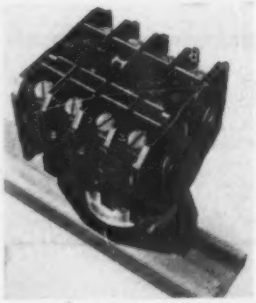
glass plate which can be easily removed for cleaning. The floodlight cradle has been designed to contain a sheet-steel control gear-box if required, and both lantern and control box are fully treated against corrosion. The reflector weighs 46 lb and measures 45 in. by 25½ in. by 6 in. deep. *AEI Radio and Electronics Components Division, 38-39 Upper Thames St, E.C.4.*

Miniature contactors

AN unusual form of mounting has been used for a range of miniature contactors recently introduced. The contactors have a double-break action with up to eight contacts and are claimed to have switching capacities up to 7 A at 400 V a.c., although versions are available for 550 V. These contactors are held in mounting channels by spring-loaded clamps. This method of construction gives a neat appearance while enabling replacements to be effected quickly. These relays are available in three types, SOO-40/42/44, for voltage ratings from 110 to 500 V and current ratings from 0·15 to 7 A. Adjustable thermal overloads can be supplied with the contactors without need for additional wiring. Typical overall dimensions of a contactor are 2¼ in. by 2¼ in. by 3¼ in. *Londex Ltd., Anerley Wks, Anerley Rd, S.E.20.*

Grouped motor control

COMPACTNESS and neat appearance characterise the new "H" range of multi-tier motor control boards recently introduced by Belmos. Suitable for direct-on-line contactor starting for motors up to 7½ h.p. at 440 V, an eight-unit column occupies a floor area over 1·3 sq ft. These grouped control panels have been designed to line-up with the company's four- and five-tier cubicles in their "G" range. The starter panels are withdrawable, contact being made by blade and clips for the motor incoming circuit and spring-loaded butt contacts for the auxiliary and main outgoing circuits. Each withdrawable panel houses a contactor with overload relay, h.r.c. fuses, stalled current-breaking isolating switch and push-buttons. Other accessories which may be fitted include ammeters, auxiliary controls and sequence interlocking. These starters are designed in accordance with BS 587 and are rated for frequent duty. They are available in five colours with a stove-enamelled finish. *The Belmos Co. Ltd., Bellshill, Lanarkshire.*



These miniature Londex relays require no fixing screws. They are retained by a spring-loaded clamp in a channel mounting bar

Panel mounting instruments by Salford Electrical have an attractive appearance, enhanced by the metal surrounds which may be coloured to match the mounting panel or for quick identification

Clear scale instruments

AN attractive range of rectangular panel mounting instruments in which care has been taken to give a legible scale with a minimum of unnecessary markings has recently been introduced by Salford Electrical Instruments. A feature of the design is the provision of an anodised aluminium front plate which can be supplied in any colour to match the surrounding panel. Moving coil and moving iron meters in the range are available in 2 in., 2½ in., 3½ in. and 5 in. scale lengths with square or rectangular bezels projecting approximately ¼ in. from the panel front. The instruments have white enamelled scales with thin blade pointers, although knife-edged pointers and mirror scales can be provided. Moving coil meters are available ranging from 50 microA to 10 A with self-contained shunt and from 75 mV to 500V. For a.c. circuits the addition of a rectifier permits use on frequencies from 15 c/s to 20 kc/s. In addition for higher frequencies or distorted waveform supplies versions are available with vacuum or open type thermocouples. Moving iron instruments can be calibrated up to 500 c/s with current ranges from 10 mA to 50 A and voltages from 1·5 to 300 V. The meters comply with BS 89. Moving coil and moving iron instruments will withstand overloads of 1,000% for short periods with reduced overloads if rectifiers and thermocouples are fitted. The moving iron pattern is available in specially scaled versions for motor starting in which the nominal running current occurs at approximately half scale deflection.

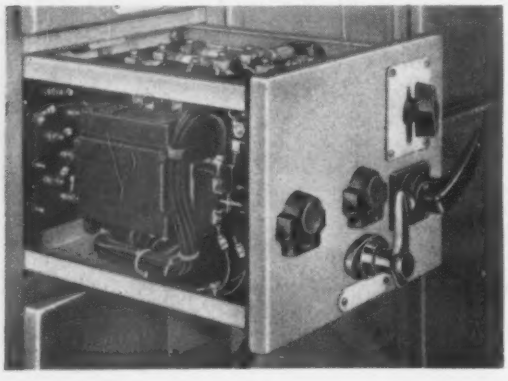
Following the recent introduction of spark gaps by the MO Valve Co., a further series has been introduced, type SG2 for voltages from 800 V-5 V. These spark gaps are intended for high voltage protection. *GEC, Magnet Hse, Kingsway, London W.C.2.*

New AEI semiconductor devices

FOR general industrial requirements, AEI have recently introduced a series of finned silicon junction rectifier assemblies. Introductions also include gold-bonded diodes, transistors and cadmium sulphide photocells. The silicon rectifiers are suitable for 10 A and are available in assemblies, mounted on 3 in. sq cooling fins, for single and 3-phase full and half-wave bridge units suitable for a maximum p.i.v. of 1,200 V at up to 24 A. Rectifier cells are stud mounted and are individually suited for p.i.v.'s from 100 to 400 V. They will operate at a junction temperature not exceeding 150°C.

Very small hole storage and low capacitance makes the range of gold-bonded diodes particularly suitable for computer and high-speed switching applications. The diodes are suitable for a maximum forward current at 25°C of 100 mA with a voltage drop of 1·1 V and maximum p.i.v. from 25 to 100. The maximum inverse currents for these p.i.v.'s vary from 25 to 100 microA, respectively. *AEI Electronics Apparatus Division, Carholme Rd, Lincoln.*

TWELVE transistors have recently been added to the company's range. They include two power transistors, XC141/2, intended for amplification and public address equipments, a series of drift transistors for switching and communication with minimum f_t's varying from 20 to 60 Mc/s. Two Mesa high-speed switching transistors, types XA161/2, have also been added to the range, having the features of low saturation resistance and stored charge with high collector dissipation. Particularly suitable for printed circuits are these transistors, and the type XB121 which is suitable for low level high voltage switching and control. An abridged data book, giving details of these and other transistors made by the company, is available. *AEI Radio and Electronic Components Division, 155 Charing Cross Rd, London W.C.2.*



A recent introduction to the Belmos range of industrial control gear is this type "H" direct-on-line, withdrawable motor starter unit for motors up to 7½ h.p. Eight starters may be mounted vertically in each section

PROBLEMS AND PRACTICE

We welcome contributions to this feature; those published will be paid for at our standard rates. There must be many problems encountered in day-to-day electrical work, or useful ideas or tools devised to make it easier; all make instructive reading.

The Brick Nearly Dropped

ION'S letter on shock treatment (14 July) recalls a similar experience of my own. For a number of years I was responsible for the electrical work at a brick quarry where, with their large motors and heavy quarry equipment, the quarterly account averaged £2,500. One quarter, the costing clerk stopped me and asked how it was that the latest electricity bill was down by some £600 on the previous one though the brick output had not changed. For the moment I said I could not explain it but probably it had been due to good maintenance with some reduction of maximum demand—they were operating on an M.D. tariff—but they should certainly take it up with the supply company. This they did, but the supply company checked back and said that all appeared to be in order. However, I suddenly recollected that the M.D. meter had been changed during the quarter and mentioned this to a supply company official who then decided to check the meter connections. He discovered that current and voltage connections were crossed on two phases and that the meter was indeed reading low. The matter was quickly rectified but I can't help feeling that, had the company not spotted the mistake and queried it with the supply company, it might have gone on for years without being noticed. The resultant bill for electricity consumed and not paid for would have been a heavy blow to the brick company.—*F. R. Ralph.*

Useful Conduit Tip

A MOST unsatisfactory state of affairs often occurs on flush screwed conduit work after the conduits have been installed, the walls plastered and the work of drawing in the cables has been commenced. All too frequently, the conduits are found to be blocked by foreign matter which takes hours to clear; in some cases sections of conduit have to be cut out.

There are many reasons for these blockages. Sometimes the obstructions enter while the conduit is lying on the floor of the building; at other times plaster enters the conduit and sets in place during the plastering of the walls. Often an electrician, recognising the risk, plugs the conduit ends with screwed-up paper which sometimes falls out, finds its way into the conduit or disintegrates upon absorbing moisture from the plaster.

A method I have recently adopted completely removes the possibility of blockages and saves much time and frustration. When a section of the installation has been completed, the steel tape is pushed through each conduit, thus ensuring that there are no blockages at this stage. A length of thread or fine string is then drawn through as the tape is withdrawn and the ends of the conduit are sealed with a cork.

When the drawing-in stage has been reached, the corks are removed and the draw-wire is pulled in by means of the thread, so removing the temptation to use the steel-tape as a draw-wire, an act which ruins the steel-tape in a very short time.

Suitable corks can be purchased from chemists or chain stores. They are quite cheap, ranging from 3s 6d a gross for corks suitable for $\frac{1}{2}$ in. brass bushes, a cost which is more than compensated for by the saving in time later on.—*W. Satchwill.*

Bovine Fault Detector

THOSE who have had the fatiguing task of patrolling an overhead line in search of a fault on a hot summer's morning with the early dew wet on the grass and a pair of thigh boots to impede progress will sympathise with me when, some years ago, I had already covered about three miles of 33 kV line mounted on steel poles, examining each insulator through field-glasses, without success. There was nothing to do but to retrace my steps for a second time and I was wearily crossing a road between fields when I stopped to chat with the local farmer. In course of conversation he happened to remark that in a particular field the cows were very frisky that morning which might presage a storm but, strangely enough, in the adjacent field they were quiet.

It so happened that the line was crossing the field in question and one of the steel poles was in the field. Subconsciously, I linked the two events together. I should mention that the line was delta-connected and was still alive with one phase showing a high resistance fault to earth on the detector. Although I could see no break on the pin insulator I reported the point as the possible source of fault. Surely enough, repair linesmen found a cracked insulator on the line and, checking further, a high resistance earth circuit between the pole and an adjacent pond. Cows, feeding on the damp grass in this line, felt a tingling in their toes and on the tongue; hence the friskiness. Since then I have heard others tell the same sort of tale, mostly at second or third hand, but to me it really happened. Replacing the pin insulator and properly earthing the steel pole cured the fault and left the cows to graze in peace.—*T. Lambert.*

Noisy Meter that wasn't

A CONSUMER complained that his electricity meter was noisy and I had been sent round to investigate. As so often happens to be the case, I could not find much cause for complaint and his wife, who was there in his absence, agreed that it seemed quiet enough but, she said, there were times when it sounded particularly noisy. I was standing on the doorstep preparing to leave when accidentally I leaned against the bell-push. As I released it the bell, instead of stopping, slowly faded away and a noticeable hum rang through the house. "That's the noise," she remarked. Surely enough, in the kitchen the bell, fed from a small transformer, was vibrating but not enough to reach the gong. Breaking the circuit at the interrupter caused the bathroom indicator to dance and a little further examination disclosed the trouble.

Ordinary waxed bell-wire laid direct in the plaster behind the tiling had corroded badly and was providing a leaky path, causing the bell to vibrate. For once the meter was exonerated to the satisfaction of the consumer.

Most supply board consumer's engineers will be acquainted with the complaint of noisy meters but only rarely is the complaint justified. Sometimes a little dirt on the jewel face will be responsible for a hum through the disc vibrating in phase with the supply frequency. A light tap on the casing will generally cure it. More persistent noise can usually be traced to worn or cracked jewels or a damaged pivot. In one exceptional case, where the noise was quite noticeable at night though the meter was comparatively quiet at close quarters, it was due to the amplifying effect of the horn created by the walls and roof of the space under the stairs at the far end of which the meter was fixed.

Talking of meters, I recollect seeing many years ago a wattmeter which was operated by pendulums in a power station. I think it was called the Aron. Are there any of these still working today or have they all been consigned to the scrap-heap?—*C. Jenkins.*

News of the Week

MORE BIDS, MERGERS AND REORGANISATIONS

Consortium acquire Phoenix Telephone

THE seven-company telephone consortium which recently lost the "battle for Temco" to Pye have now acquired control of Phoenix Telephone and Electric Holdings Ltd. Operating through a new company named Combined Telephone Holdings Ltd., which was registered on 11 July with an initial capital of £100, the consortium have agreed to buy more than 50% of the Phoenix 5s Ordinary shares for 15s cash per share.

They propose to bid for the remaining holdings on the same terms and to offer 17s 6d each for the Phoenix £1 5½% Preference shares. Value of the total bid is just under £1 million. Last May it was reported that Phoenix incurred a "very substantial" trading loss over the preceding financial year. In addition to telephone equipment, Phoenix have developed an appliance manufacturing side to their business.

Schenectady-Midland

A NEW company, Schenectady-Midland Ltd., has been formed jointly by the Schenectady Varnish Co. Inc., USA, and Midland Tar Distillers Ltd., Birmingham, to manufacture and market the products of the American company in the UK.

Schenectady Varnish Co. claim to be one of the largest manufacturers in the world of insulating varnishes and wire enamels for the electrical industry, and their range includes industrial resins and coatings used in various products.

Piped TV in Scotland

A CONTROLLING interest in Aerial Developments (Glasgow) Ltd. has been acquired by General Piped Television Ltd., and the name of the subsidiary has been changed to General Piped Television (Scotland) Ltd. The company will operate a television relay system in Scotland similar to the one being currently operated by Piped Television (Wales) Ltd. GEC hold a minority interest in the parent concern and provide technical assistance for the signal distribution.

Instrument Firms Merge

THE merger of Cambridge Instrument Co. Ltd. with Electronic Instruments Ltd. (referred to on 7 July) has been completed. Cambridge have received 100% acceptance of their offer to EI shareholders, Electronic Instruments Ltd. will continue to trade under its own name and trade mark. Mr P. Goudime, the managing director, has joined the board of Cambridge Instrument Co., and from the latter board, Dr P. Dunsheath (chairman), Mr H. C. Pritchard (managing director) and Mr. W. E. Lamb have joined the board of Electronic Instruments Ltd., of which Mr A. C. W. Norman continues to be chairman, Mr Goudime, managing director, and Mr D. A. Pitman, sales director.

Prestcold Marketing Plans

DETAILS of a new plan covering the development of the Prestcold marketing organisation were announced by Mr D. A. Field, the company's sales director, at the opening of their new showroom at Chester last week. Under the plan, Prestcold intend to acquire the businesses of their distributors in England, and will, in their place, set up Regional Marketing Units which will, within limits, operate autonomously. A number of these have already been purchased and negotiations are in hand for others.

Terms for Rheostatic

TERMS of the bid made by Elliott-Automation for the £150,000 Preference and £985,600 Ordinary share capital of Rheostatic Ltd. have now been announced.

Elliott are offering three 7% Cumulative Preference shares of £1 and seven Ordinary shares of 5s for every ten Rheostatic Ordinary 4s units. In addition, for every ten Rheostatic 10s Cumulative Preference shares, Elliott are offering three 7% Cumulative Preference of £1 and two 5½% Cumulative Preference of £1.

Automation Unit for Steelworks

A JOINTLY financed organisation known as the Steelworks Automation Unit has been formed by AEI and Davy-United Ltd., steel-works plant manufacturers of Sheffield, to apply new automatic control techniques to the processing of steel and non-ferrous metals. Headquarters of the unit are at Mill Rd, Rugby, with representatives both at Davy-United, Sheffield, and AEI Heavy Plant Division, Rugby.

The combined automation unit has been specifically organised to deal with problems of automatic control from initial design study to the commissioning of a fully operational production system in a plant, AEI state. The unit will undertake comprehensive automation projects, including the combination of advanced servo controls with computers to ensure optimum performance of rolling mills and associated plant.

Simplex, Mersey, Power Centre Integrate Selling Organisation

THREE companies within the Electrical Division of Tube Investments, Simplex Electric Co. Ltd., Mersey Cable Works Ltd., and the Power Centre Co Ltd., have integrated their industrial sales organisation. As from 1 August, these companies established a unified selling unit operating from 22 Simplex branches situated throughout the country.

This integration is intended to benefit all customers—commercially and technically—with quick service. Specialist staff will be located at each company's head office to attend to direct technical inquiries or non-listed special products or services.

Morgan Crucible Reorganisation

REORGANISATION of the Morgan Crucible group, which has been in progress for some 12 years, is now to be completed, it was announced at the annual meeting last week. Four additional wholly owned subsidiaries are to be registered; the group's home trade will then be carried on by 11 subsidiaries and its export trade by 12 overseas subsidiaries and Morganite Exports Ltd.

From 1 April, 1961, the parent concern, Morganite Crucible, will cease to be a trading entity but will retain its Battersea address.

The group's range of products will then be manufactured and sold in the UK by the following three wholly owned subsidiaries: Morganite Carbon, Morganite Crucible and Morganite Electroheat. Research activities will be conducted by Morganite Research and Development.

E.D.A. Sales Conference, 1961

SO successful was the EDA Sales Conference and Exhibition at Harrogate last March that it has been decided to hold the 1961 conference there. Manufacturers have also been asked if they are in favour of an exhibition again.

Objection to Holme Pierrepont

MAINTAINING their objections to the proposal of the CEGB to erect a new steam power station at Holme Pierrepont, Nottinghamshire County Council last week approved, by 39 votes to 21, the report of the Planning Committee who suggest a public inquiry. The latter committee consider it essential that the CEGB should be required to justify their proposal.

The committee have, however, granted consent to the application of the board for the erection of a coal-fired station at West Burton.

Production ups and downs

ALTHOUGH production in the electrical and engineering goods industries in May was 10% up on a year earlier, the index figure of 129 (1954=100) was down on March (137), and the increase was substantially less than the increase of 13% over the first four months of 1960, partly because engineering output was expanding vigorously in the second quarter of 1959. These figures were disclosed by the Board of Trade last week.

New orders for electrical and engineering goods continued to flow in at a high rate during May, however, and orders on hand, mainly for capital goods, increased still further, showing a gain of some 10% on the same month last year.

"Why was Edern by-passed?" asks C.C.

"WHILE congratulating Anglesey on their good fortune in the CEGB's decision about the siting in that county of the second North Wales nuclear power station, the Caernarvon County Council are very much concerned about the manner in which this matter has been dealt with." This is part of a joint statement by Mr R. W. Williams, (chairman, Caernarvonshire Industrial Development Committee), Mr R. H. Owen (chairman, County Planning Committee) and Mr J. E. Owen-Jones (County Clerk), in which they emphasised that the county council had earlier welcomed the establishment of such a station in Caernarvonshire. They even supplied the CEGB with particulars of three sites, at Clynnog, Llanystumdwy and Edern, together with the council's views on the sites from the planning (including amenity) aspect.

When the board announced in February, 1959, that they proposed to examine sites in Anglesey no explanation was then given as to why they found it necessary, 18 months after declaring the Edern site suitable.

In the board's latest pronouncement on the choice of Wylfa, no reason was given as to why the site was preferred to Edern —neither was it stated that it was a better site than Edern nor was there any reply about the influence of amenity bodies, the statement adds.

Representatives of the council, with Mr G. Roberts, M.P., recently met the chairman and officials of the CEGB and expressed forcibly the council's dissatisfaction in the way which the board had dealt with the matter.

The council consider they should have been consulted further if views submitted by amenity bodies which were contrary to the views of the county council, and the local planning authority, were being considered. "Such other views should have been referred to this council for testing as to the validity and weight before being accepted by the board," the statement goes on.

"The present situation indeed leaves the council in some doubt as to the effectiveness and fairness of the machinery and arrangements whereby the views of the representative body, in this instance, might be communicated and considered

"The council are also of the opinion that the indefinite postponement of the Edern project, added to other disappointments, entitles the county, especially Lleyn, to special measures by the Government to introduce other forms of industry to the area."

Mr G. Roberts, M.P. for Caernarvon, subsequently pointed out that as soon as the intention to develop Edern was announced there was an outcry from the Council for the Preservation of Rural Wales. Propaganda against the project, although confined to a small minority, many of whom did not reside in Lleyn, was incessant, he went on. "We shall now press for a major factory for the area. Will the C.P.R.W. object to that also? Having wrecked the Edern project will they now support demands for a major new factory in the Peninsula. Or do they object to everything except the proliferation of road-houses, which desecrate the area in more senses than one?" he demanded.

Lowestoft changes over

A FORMER chief engineer and manager of the Lowestoft Corporation Electricity undertaking performed the final switch-over ceremony a few days ago when the last d.c. supplies in Lowestoft were changed over to a.c. The change-over work originally started in 1933 and considerable progress was made up to 1939, but capital restrictions had since delayed completion. The final switch-over involved only six dwellings and the British Railways' sleeper depot. The ceremony was performed by Major G. A. Bruce, aged 86 and now living in retirement in the town where he was chief 59 years ago.

96% Rural Electrification

IN the Forest of Dean district, 96% of the farms are electrified, leaving only about 30 farms and 400 other rural premises to be connected, Mr W. S. Lewis, chairman of the Midlands Electricity Board, announced at the opening of a new M.E.B. service centre at Cinderford. He did not think there could be many other rural parts of Britain with such a high degree of rural development as the Forest.

Earlier, Mr Lewis had pointed out that they had spent more than £1 million over the past 12 years in providing adequate electricity supplies in the Forest of Dean.

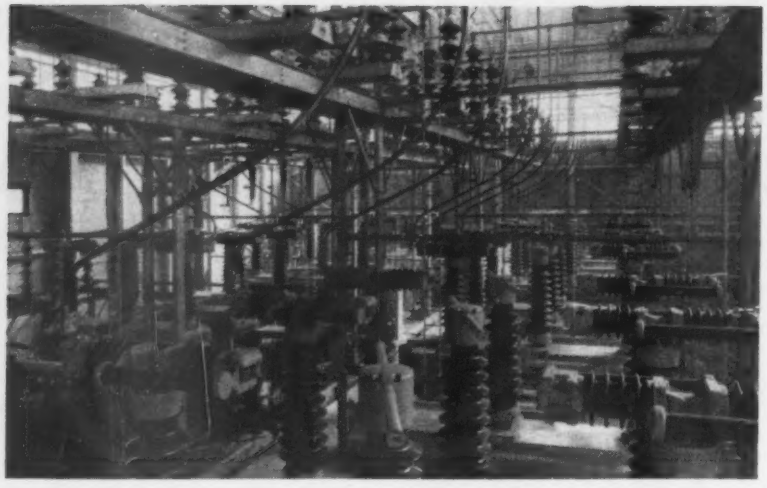
The new showrooms have electric floor-warming, and the heating cables have been extended to run beneath a strip of pavement outside the window and along the passageway at the side.

At the ceremony, Mr S. Raybould, manager of the Central Gloucestershire sub-area, pointed out that during the past ten years, the number of consumers in the Forest had risen from 9,250 to 15,300, the number of farms connected from 170 to 557, and average domestic consumption from 900 units to 1,880 units.

Manual Workers' Claim

WITH no definite decision reached at last Friday's meeting of the N.J.I.C. sub-committee, the pay claim for manual workers in the Electricity Supply Industry reached deadlock. This could lead to more threats of other action when the union leaders meet to consider the position on 9 Aug. The unofficial shop stewards' organisation, which has circulated an appeal to station staff, is arranging to meet on 6 Aug.

Three of these giant, crystal and gold-plated chandeliers have just been ordered for the Grand Palace Bangkok, from GEC. 11½ ft high, and over 6½ ft dia, they each have 7,800 crystal drop and 45 three-light candelabra arms. Also ordered were 64 Georgian gold-plated chandeliers with matching brackets and 121 floodlights



Built indoors as a protection against atmospheric salt deposit, the 132 kV switching station associated with Hunterston nuclear power station is nearing completion. It is equipped with AEI switchgear. The compact design of the c.b's and special arrangement of busbars and isolators has achieved a notable space-saving. The air-blast c.b's are rated at 3,500 MVA at 132 kV

Investigation in E.T.U. Election

ALLEGATIONS that in the election for the position of assistant general secretary of the Electrical Trades' Union postal votes were sent by people not entitled to vote or who had already voted, were made in a High Court action last week. Mr N. Lawson, Q.C., for the union and the three officials, Mr F. Foulkes (president), Mr F. Haxell (general secretary) and Mr R. McLennan (present assistant general secretary), said the allegations were denied, but it was "conceded there is a position requiring investigation."

Mr F. Chapple, a candidate for the post of assistant general secretary, was granted interim injunctions restraining the defendants until trial or further order from continuing to hold the election or from publishing the purported results of votes cast.

For Mr Chapple, it was explained that the union's branches had to notify the general secretary of the number of members entitled to vote, and it was then the responsibility of the general secretary to have printed certain documents, including ballot papers, election addresses and envelopes, which were sent by the printers to the branch secretaries for distribution to individual members. There was no means on the documents of identifying the member voting.

The controversy was that postal envelopes were sent to branches by members not entitled to vote or who were voting for a second time, and that could not have happened without the responsibility of the defendants. In this case it was said that the officials of two branches became suspicious, and the envelopes were date-stamped before dispatch to the members. When the branch officials counted the returns for the Wolston (Southampton) branch 20 votes were in envelopes not date-stamped, of which 18 were for Mr McLennan and two for Mr Chapple, while for No. 5 London Station Engineers' branch there were 37 such votes, all for Mr McLennan. Those votes altered the result of the election.

It was also stated that evidence had been received of somewhat similar happenings at Southampton Central branch.

Outlook for Temco

UNDER the acquisition of Pye Ltd., the Telephone Manufacturing Co. Ltd. will have the full support in every way of the Pye group, employees of T.M.C. have been told. Mr C. O. Stanley, chairman of Pye, has stressed that the people need have no fear about the future, in fact, their position will be improved as members of a larger organisation. Mr C. H. Jackson is to continue as chairman of T.M.C., but Pye are to appoint one of their directors as vice-chairman.

Sierracote in the U.K.

ARRANGEMENTS have recently been completed for the production of "Sierracote" conducting films in this country by D. Napier and Son Ltd. at their "Spraymat" factory in Luton, under licence from the inventors, the Sierracin Corporation of Firbank, California. A group of Napier engineers are already in California learning the production techniques and factory space at Luton is being equipped ready for their early return.

"Sierracote" is a method of producing a conducting surface on vinyl films for attachment to glass or other transparent media. It can be used for de-icing windscreens on aircraft or other forms of transport where at present only glass screens with conducting metal surfaces applied by the expensive cathodic sputtering or high temperature fusing techniques are available. It is also applicable to electroluminescent panel production and for photoelectric cell covers.

Exports Insurance Record

EXPORTS insured under the Exports Credits Guarantee Department scheme for the second quarter of 1960 were a record for that particular quarter, though below the all-time record of the previous quarter. £161·6 million was declared as shipped, compared with £178·9 million in the previous quarter and £155·2 million in the second quarter of 1959.

The number and face value of short-term policies current at the end of the quarter—4,996 policies for a total of £673·6 million—were an all-time record. Medium-term policies issued during the quarter amounted to £39·3 million compared with £20·2 million for the previous quarter.

More on Telephone Agreements

AGREEMENTS between the PMG and manufacturers of telephone equipment for supplies to the Post Office are not registerable under the Restrictive Trade Practices' Act. Some MPs were upset to learn this from the President of the Board of Trade last week. He explained that there were clear provisions in the RTP Act that agreements are not registerable where Crown privilege is involved.

During question time Mr Bevins, the PMG, commented on Mr C. O. Stanley, of Pye, that: "Mr Stanley has made a lot of statements in recent weeks, not all of which have been completely accurate." On the question of telephone handset prices, he said that the French handset was rather more expensive than the British, but the German was cheaper. However, the total cost of handset and of installation in Germany and this country were almost identical.

Later the PMG recalled that about 12 months ago the Post Office invited "firms outside the ring" to contract for cabling. No tenders were received. He revealed that consideration is being given at present to going out to tender for another bulk supply.

OFFICIAL PUBLICATIONS

Hydraulic Research, 1959. DSIR Report. HMSO, 5s 6d (see page 175).

BS 3228. Procedures for obtaining properties of steel at elevated temperatures. Part 1, proof stress, 3s.

London Transport in 1959, 2s 6d (see page 185).

Ministry of Power Statistical Digest, 1959. HMSO, 30s (see page 175).

Eire Electricity Supply Board. Report for 1959-60, 1s (see page 180).

Coal Consumers' Councils' (Industrial and Domestic) Report, 1959/60. HMSO.

Large Oil-filled Cable Contract

SOME 8,000 yards of 132 kV feeder cables, 4·85 in. in diameter and the biggest oil-filled h.v. cables to come from the AEI works at Gravesend, have been installed by AEI Construction (Cables and Lines) Division's engineers in Leicester during the past few months. The cables are of the 0·6 sq in. three-core, oil-filled type with compacted circular copper conductors and aluminium oil ducts, single lead alloy sheathed and tin bronze reinforced.

The contract, valued at over £100,000, was awarded to AEI by the East Midlands Electricity Board as part of a scheme to reinforce the electricity supply in the northern area of Leicester.

"POWER NEWS"

THE first issue of *Power News*, a monthly newspaper of the CEGB, is a very readable effort intended for circulation throughout the organisation. In addition to news of the industry, the first issue contains contributions on a variety of subjects, both serious and humorous.

Trade split "inevitable"

A DIVISION in the trading systems of Western Europe is for the time being inevitable, but prospects for the UK are nevertheless encouraging. These facts emerged from last week's House of Commons debate on the problems of achieving European economic and political stability.

Both sides of the House agreed that Britain could not join the Six under present conditions, although in due course a Common Market might be evolved in which Britain could participate along with the other countries of the Seven. But the idea of the original Free Trade Area was completely dead.

Stating the Government's aims, Mr Selwyn Lloyd said that Britain had to develop in every possible way her trade and relations with the countries of the EFTA. There were "many promising opportunities."

There was no reason why EFTA trade with Europe should not expand in view of the general prosperity of Europe, he went on. "I am not at all sure that there is not a little too much defeatism in some quarters about the future of our trade with the Six."

In the coming winter it would be the UK's policy to reduce as far as possible the discrimination between the two trading groups of Europe, by playing a full part in the GATT conference in order to bring about a useful reduction in the level of world tariffs.

Meanwhile, the biggest problem in achieving UK unity with Europe was Britain's role in the Commonwealth. The Government was not prepared irresponsibly to offer to subordinate itself in a European Parliament just to get into the Common Market "on the best possible terms."

Speaking for the Opposition, Mr Harold Wilson admitted that the case for joining the Six was a strong one, but he felt that Britain could not take the plunge in "a choice of evils."

Mr Maudling, President of the Board of Trade, said that the EFTA was now a fundamental part of the British policy. He thought that a trade association between the Six and the Seven which brought the Six in as a single group was a possibility well worth examining.

Cookery Corner

"COOKER CORNER" is to be a feature of the 1960 Boys' and Girls' Exhibition at Olympia from 16 to 27 August. On a stand organised by the Modern Cooking Promotional Committee a wide range of new electric cookers made by MCPC members (Belling, Carron, Creda, English Electric, Falco, GEC, Jackson, Revo and Tricity) will be displayed.

DAMAGES CLAIM FAILS

A CLAIM for damages by a chargehand against the Southern Electricity Board was rejected in the Oxford County Court. The chargehand, Mr H. J. Brooks, alleged that servants of the Board had been negligent in not instructing him adequately before giving him a demolition job, or to take adequate precautions. He stated that he was sent with instructions to dismantle brickwork on a feeder-pillar at Abingdon so that a new cable could be laid. While using a hammer and chisel there was an explosion as the chisel struck a live cable. He maintained that he had not expected to find a cable in that position. From his experience of cable-laying to feeder-pillars he understood the practice was to bury the cable about 1 ft below the bottom level of the brickwork.

He maintained that Mr C. J. Bernthal, SEB engineer on the site, had told him the existing cable entered the feeder-pillar from the rear, but Mr Bernthal, in evidence, said the upper part of the cable in the trench was exposed to within 6 in. of the pillar. Its direction was quite obvious. He denied telling Brooks that the cable to be replaced came out of the rear of the pillar or that all three cables did so, but pointed out the cable to Brooks before he began the job.

The judge, Sir Edgar Dale, held that Brooks had failed to prove any of the allegations of negligence against the Board.

Equipment Orders

AN order valued at over £100,000 has been obtained from the USSR for heavy type wire braiding machinery and winding machines by B. and F. Carter and Co. Ltd.

AEI Transformer Division has received an order from Vauxhall Motors Ltd. for a 20 ft, 180 kW infra-red oven for drying cellulose paint. It is the twelfth oven ordered from AEI by Vauxhall's.

Substitution of four 18 in. 15 W Philips fluorescent tubes for one 150 W tungsten lamp in each of 1,600 semi-recessed fittings in the Mersey Tunnel has almost trebled the brightness and halved running costs. Conversion, costing £12,000, was carried out by Liverpool Corporation engineers under the direction of Mr C. C. Smith, city lighting engineer

The Commons and Electricity Supply

FROM next session, the House of Commons will have new opportunities for debating expenditure on the nationalised industries, including the Electricity Council and the various boards. This will come about by publication of two documents, foreshadowed in the budget debate earlier this year. Each autumn a White Paper will be published setting out the investment programme for what is called the public sector of the economy, which includes the nationalised industries. The Government proposes that there shall be a whole day debate on this White Paper before Christmas each year. Additionally, there is to be published each February or March a White Paper on estimated borrowing by nationalised industries (from the Treasury under present arrangements) during the following financial year. Borrowing will usually be less than investment, due to the self-financing element.

The pre-Christmas debate will be taken out of the three days the Government allocates at present for discussion of report of specific nationalised industries. It is suggested that the remaining two days may be used to debate reports of the Select Committee on Nationalised Industries.

SHOWTIME

Half of the joint stand of Manweb and EDA at the Royal Welsh Show, at Welshpool, last month, was given to domestic apparatus, including the latest developments. Our photograph above (left) indicates the attraction these aroused. The other half of the stand was devoted to apparatus for all branches of farm work. On the right is an exterior view of the Yorkshire Electricity Board's stand at the Great Yorkshire Show, at Harrogate, where a full range of electrically powered or heated agricultural equipment was also exhibited. This included a large horticultural section

Washing machines "in the rent"

WASHING machines and spin dryers for 1s 9d a week over a period of ten years are to be offered to council house tenants in South Wales under a scheme devised by the South Wales Electricity Board. Local councils in the area are being offered an opportunity to buy appliances in bulk at a quarterly discount for resale to their tenants with instalments spread over seven to ten years.

If the councils approve the scheme, the machines will be supplied and installed by Hoover, who will guarantee them for 12 months and maintain them for a specified period.

"We are only sounding out these councils as to whether they would be interested in a project of this sort," a SWEB spokesman said last week. But the Borough Treasurer of Neath housing committee said he could not understand why the board were offering a longer period of repayments than those available to the public under normal h.p. regulations.

A Hoover spokesman explained that there was no limit on the period of repayment by tenants because the councils would be buying in bulk and paying in cash, adding: "They can get the money back on the rent card over whatever period they like."

The scheme is claimed to be rental rather than hire-purchase, and has been "tried with success" in London and the North of England. Neath council are also to discuss an offer by the board to supply tenants with immersion heaters at a charge of £8, or 17s 8d a quarter, with no responsibility or expense put on the council.

Plastics Production Progress

THE Maydown works of the Du Pont Co. (UK) Ltd. built to produce neoprene synthetic rubber, was officially opened by the Governor of Northern Ireland last week. Although the plant was designed for production of 50 million lb of neoprene a year, plans have already been prepared for a 20% increase in capacity. At present some 400 people are employed at the works which has been built on a former R.A.F. airport just outside Londonderry.

Production trials are to take place later this year for the manufacture of "Melinex" polyester film at the Imperial Chemical Industries plant at Drungans, near Dumfries. Employment will eventually be provided for over 200 persons by the ICI Plastics Division. Initial production is expected to be some 2,000 tons annually.

Pioneers — by Ferranti

WHILE most well-known electrical firms have a history extending back to the early days of electricity, none has the close personal link of Ferranti. This is brought out in a film recently released by the company, which outlines some of the technical achievements of Dr de Ferranti against the early background of the industry. His work at Grosvenor Galleries, his alternators, the first paper-insulated cable and early electricity meters receive particular attention and the latter leads on to a description of the modern mass-production techniques used in the manufacture of meters today. The film, entitled "The Pioneers," is produced in colour.

BEAMA Semiconductor Section

A SEMICONDUCTOR Devices Section has been formed by BEAMA. To co-operate closely with the Valve and Semiconductor Association, it will also foster standardisation both on a national and international basis. Chairman is Mr L. E. Thomson, of Westinghouse Brake and Signal Co., and secretary, Mr C. Brooks, at The Red House, Ascot, Berks.

Initial members are AEI, Electric Construction Co., English Electric Co., Ferranti, GEC, Hackbridge and Hewittic Electric, International Rectifier, Philips, Standard Telephones, and Westinghouse Brake.

Stole £1,229 — 12 months' jail

PLEADING guilty to stealing a total of £1,229 from the Midlands Electricity Board, Mrs. C. I. Livingstone was sent to prison for 12 months at Worcestershire Quarter Sessions. She admitted four charges of stealing from the board where she worked as a senior service centre assistant. It was stated that the money had been used for gambling on greyhounds.

B.E.A.M.A. support collaboration in International Standards Work

BEAMA support for an arrangement whereby the members of the European Free Trade Agreement (the "Seven") accept collaboration in the two-year-old work of the European Economic Community countries (the "Six") to secure common engineering standards, is expressed in a policy statement issued last week. The decision of "Six" and "Seven" to collaborate on an equal footing in the field of standardisation was reached at a meeting held in Zurich recently. The 13 countries concerned are to work as equal partners towards alignment of Western European standards, and maximum development of international standards through ISO, IEC and CEE. The BEAMA Council says it "considers it essential that the UK should play an active part in such developments, and strongly supports any such efforts towards a greater degree of harmonisation in international standards and practices than has existed previously." The industry's policy, the Council believes, should be governed by the will to reach agreement and a willingness to effect reasonable compromises.

Guernsey Tariff Down

THE third tariff reduction within 12 months is announced by the States of Guernsey Electricity Board. In this, the step in the commercial block tariff charged at 2d is eliminated, and on units over 20,000 per quarter the percentage charged at 7d is reduced from 10% to 5%.

Slim surplus for L.T.E.

SERVICE economies, possible with the fall in passenger traffic and elimination of losses occasioned by the 1958 bus strike, are reasons quoted for London Transport's slim surplus of £30,000 on gross receipts of £81·1 million. Increasing congestion and staff shortage were again blamed for loss of service regularity. The annual report shows that 11·6% fewer passengers were carried last year than in 1957 largely due to the 1958 strike. On the Underground, however, there was an increase on 1957 of 0·4%.

The three-year programme for replacement of trolley buses is now at the half-way stage. On the Underground, the £9 million scheme for modernisation is progressing. Modernisation of the Underground power system has reached a further stage with a £3 million scheme for improving 14 substations.

60 years of Central Line

LAST Saturday, London's underground Central Line celebrated its diamond jubilee. On July 30, 1900, the newly completed 5¼-mile Central London Railway was opened to the public for the first time, and on that day 84,500 passengers travelled on electric trains for a flat fare of 2d for any journey between Shepherd's Bush and Bank.

To mark the occasion London Transport are holding a special exhibition at Charing Cross Underground station from 9 Aug. to 7 Sept.

Last week also saw the introduction of the first of the new eight-car "silver" trains which, with their 15% extra capacity, will eventually replace all the older trains at present running.

Sayings OF THE WEEK

"Much of the 'joy' and profit from exporting is lost by the clerical work and documentation involved which is a serious deterrent to the smaller firms considering overseas trade." . . . H. E. JONES, secretary, British Association of Machine Tool Merchants.

"It's very embarrassing for me, as a psychiatrist, to go to business lunches because I see so many of my patients." . . . DR A. A. MASON, at the Batti-Wallahs' Society luncheon.

"The Netherlands Railways, which have always shown a profit on their operations, have over the years electrified just over half their system." . . . MR S. F. STEWARD, director, BEAMA, writing to the *Financial Times*.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, August 2

	£ per ton	Weekly change £
COPPER, standard class A (settlement)	253½	+2
" (3 months)	248½	+2
LEAD, refined pig, 99·97% purity (cash)	71½	+½
" (3 months)	71½	−¼
TIN, refined, min. 99·75% purity (settlement)	814	−4½
(3 months)	815	−3½
ALUMINIUM, ingots 99·99·5%	186	—
" wire bars (4"×4"×54")	193½	—
BRASS Strip 63/37	218½	—
SILVER (Troy oz)	79¼d	—

	£ per ton	Weekly change £
ZINC, virgin, min. 98% purity (cash)	88½	−2½
" (3 months)	88½	−1½
RUBBER, per lb.		
No. 1, R.S.S. spot	30½d	+1d
c.i.f. basis, ports, Oct.	31d	+⅛d
ARMOURING:		
Galv. Steel Wire (0·104 in.)	66½	—
Mild Steel Tape (0·04 × 1½ in.)	53*	—
NICKEL (home)	600	—
MERCURY (76 lb flask)	70½	+½
AMERICAN PRICES:		
Copper, electrolytic (per lb)	33c	—
Lead (New York)	12c	—

** Tape Price, now an average, includes varnishing*

Build store far away, firm told

A MIDLANDS firm has been told by the Board of Trade that it cannot build a store next to its factory, but must go elsewhere. An industrial development certificate would be granted if the store were built in Wales, Northumberland or Durham. Mr Graham Clayton-Wright, managing-director of the firm (Howard Clayton-Wright Ltd., of Wellesbourne, specialising in rubber and plastic components) said last week that he did not intend to let the matter rest, although he suspected that he had no right of appeal.

"The silly part about this business is that since it is only going to be a store, the number of people employed will certainly not be more than 30 at the most. Quite half of these are already occupied on similar duties at our factory, so that, assuming we were mad enough to build a store elsewhere, the employment of 18 people would not assist the unemployment situation one bit."

At present parcels of materials are stored in passages at the factory and a lean-to shed, normally used as a garage, has been converted into a makeshift store. "If our attempts to get a new store fail we shall be compelled to go on making do like this, but that is not an economical thing to do," Mr Clayton-Wright added.

Scottish power merger objections raised

ALTHOUGH there is still no confirmation or denial of the rumour of a possible merger of the two Scottish Electricity Boards (ELECTRICAL TIMES last week) several authorities in Scotland have already voiced objection to the idea. Sutherland County Council, for instance, are seeking information on the matter from the Secretary of State for Scotland, to whom they have "protested most strongly at any suggestion of such a merger."

At last week's special meeting of Inverness Town Council, Provost R. Wotherspoon said: "We are the last people to want the powers of the Hydro-Electric Board reduced in any way. We are behind them in so far as their independence and their identity are concerned."

Plea for coloured fuses

THE dangers arising from the use of wrong types of fuses and the overloading of electrical installations by excessive use of adaptors were referred to at a meeting of the Southern Electricity Consultative Council last week. Many householders did not realise that there were different kinds of fuses, a council member said. It would be better if the public could ask for a certain coloured fuse so that a dealer could supply one of the correct rating.

Furthermore, people could buy as many adaptors as they liked, so overloading the supply circuit with possibly disastrous results. The council agreed to recommend that the Electricity Board should consider including a warning on these points in a revised version of the pamphlet "All about Electricity."

News in Brief

H.M. Prison Commissioners have appointed E. G. Irwin and Partners Ltd. as consultants for some of the electrical and mechanical work being carried out in their programme. Styal, in Cheshire, Wormwood Scrubs, Wakefield and Lincoln are four of the prisons on which work is being done.

There are to be discussions between the Minister of Housing and Local Government and representatives of the Parliamentary and Scientific Committee in regard to proposals for the rating of scientific organisations, the House of Commons was told in a written answer last week.

Production of specialised equipment by Ekco Electronics Ltd. has been transferred from Southend-on-Sea to the partly completed works at Ashingdon Road, Rochford, Essex. In the near future, production of radar and associated equipment will be transferred from Malmesbury to the new works.

Company Activities

MORE than a usual amount of results, news, statements and comment from electrical companies flooded into financial circles last week and although in the main it was encouraging material for Stock Markets to digest, electrical share prices for the most part moved in the negative, downward direction. But this was in line with share prices generally which seemed particularly to be taking their cue from a much depressed Wall Street and, at home, by the £99 million rise in bank advances in the month to mid-July.

One company, however, which did see its 5s ordinary shares go higher over the week from 37s 6d to 38s 6d was Berry's Electric Magicoal on chairman Mr Raymond Berry's statement to shareholders. In the year to 31 March, 1960, sales increased by 43%, while the upward trend in production and sales has been maintained in the first quarter of the current financial year. Significant, too, is his comment on hire purchase: "We are of the opinion that hire purchase is not a major factor in the sale of our products. . . ." New products have been marketed with success and others are planned before winter. Moreover, exports advanced last year by 10% to a record figure while exports of "Magicoal" fires to the United States jumped by 25%. It was all this sort of expansion, of course, which enabled Mr Berry to lift the dividend from the equivalent of 13⅓% to 30%. Even at 38s 6d with the dividend 3·6 times covered the shares do not look overpriced to yield 4%.

Then, out at the end of the week, came the Elliott-Automation takeover terms for the Rheostatic Co. They are three 7% £1 cumulative preference and two 5½% cumulative preference shares in Elliott for every ten 6% 10s cumulative preference in Rheostatic. For every ten Rheostatic 4s ordinary shares Elliott is offering three 7% £1 cumulative preference shares and seven of its 5s ordinary. Philip Hill Higginson, Erlangers, and Hambros Bank offer to acquire for 20s cash any of the new 7% Elliott-Auto preference shares allotted to Rheostatic ordinary shareholders who do not wish to retain these shares. Rheostatic's board have recommended Elliott's offer. On the basis of the prices ruling when these terms became known, i.e., valuing Elliott's at 25s 3d a share, and assuming holders take cash for the preference, the offer gave Rheostatic's ordinary a value of 23s 7½d against 22s in the market.

Thorn Electrical Industries was also one of the few scorers over the week. The 5s ordinary shares finished the week's business 2s 1½d dearer at 50s 7½d on satisfaction with the year's results—group trading profits nearly £1 million up at £3,916,990 plus a 5% jump in the dividend to 25%—and the proposed one-for-one free scrip issue. At 50s 7½d the shares are now on a 2·5% dividend yield basis with the new 25% dividend well over three times covered by earnings. This looks a high enough price for the moment although the shares have been as high as 55s 7½d this year.

Then there was the long list of not too frightening falls in the rest of the electrical share market. GEC came back 2s to 33s 3d the year's "low" on the chairman's statement that prospects for the current year are uncertain and this may have contributed to the 1s 7½d fall in English Electric to 36s 3d and the 9d drop in AEI to 49s 9d.

BICC, EMI and C. A. Parsons were all a dull market, but Philips Lamps at 11⅛, and Pye, the Temco conqueror, at 16s 7½d, were able to add a little cheer.
—*From our City Correspondent.*

Allied Insulators Ltd.

This concern, which was formed last year by an amalgamation of Bullers Ltd. and Taylor Tunnicliff (Electrical Industries) Ltd. is making a one-for-one scrip issue.

Berry's Electrical Magicoal Ltd.

With a sales increase of 43%, net profit before tax rose by 70%, largely due to higher sales of fires. Over £100,000 was spent during the year on new plant and improvements at the factories, and a similar amount will probably be spent this year, Mr Raymond Berry, the chairman, reports. A modern factory at Bletchley has also been purchased. In the first quarter of the current year, the upward trend in production and sales has been maintained, unaffected by the credit squeeze.

Year to 31 Mar.	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1956	171,023	74,469	59	—	6/7	5/6
1957	169,720	65,896	47	10	6/7	3/6
1958	122,647	40,908	25	10	11/6	5/9
1959	268,692	119,335	88	20	33/9	7/1
1960	455,920	207,801	107	30*	38/9	30/7

* Plus 50% capital bonus

Cables Investment Trust

After tax, net profit for the year to 30 June is £523,641 (*£440,843*), and a final dividend of 1s. 2d. per £1 unit makes total distribution 2s (*same*).

Efco Ltd.

For the year to 31 March, group profit is £289,881 (*£299,877*), and net profit is £152,890 (*£156,061*). A final dividend of 15% makes the total 20% (*17½%*).

Electrical Components Ltd.

Gross trading profit for the year to 31 March last increased to £342,811, compared with the previous year's total of £286,526. Taxation absorbs £173,952 (*£145,335*). Final dividend is 7½% making 11½% for the year, against the equivalent of 10% last time.

General Cable Manufacturing Co.

A substantial loss resulted from trading operations in the six months ended 31 March last, Mr C. W. R. Pantlin, the chairman, reports. The loss is due to the uneconomic market conditions. The abandonment, on 1 May, 1959, of the traditional pricing arrangements by the leading companies in the cable industry has had far-reaching results and it is estimated that the price war which followed the collapse of prices may already have cost the industry a sum approaching £10 million, he states. The recent price increases have only become effective to a minor degree owing to long-term contracts and it is anticipated that any major improvement will not be possible until next October.

Parmiter, Hope and Sugden

Although turnover was maintained in the past year, rising costs, plus increased expenditure on development and testing, reduced the trading profit, and prices of all products were raised 5% in July, the directors report.

Pirelli-General Cable Works

The effect of the cable price war is reflected in this concern's results for the year to 31 March last, when profit dropped to £264,141 from the previous year's total of £805,959. After taxation at £59,737 (*£296,195*), the net profit is £204,404 (*£509,764*). Dividend is cut by 5% to 10%.

Thorn Electrical Industries Ltd.

Group trading profit for the year to 31 March last set another record, rising to £3,916,990, compared with £2,953,536 in the previous year. After depreciation charge of £764,082 (*£625,822*) and taxation at £949,069 (*£927,257*), the net profit amounts to £1,525,988 (*£979,371*)—another record. Dividend is raised by 5% to 25%. The company also realised a surplus of £1,336,264 mainly from the sales of shares in certain subsidiaries which have not contributed materially to the trading profit of the group. This surplus has been added to the General Reserve, from which it is proposed to capitalise £2,187,708 in the issue of 6,613,330 Ordinary and 2,137,500 "A" Ordinary 5s shares on the basis of one new Ordinary or "A" share for each share held.

Ward and Goldstone Ltd.

Mr Sampson Goldstone, chairman, told shareholders last week that the contract for wiring for Ford's Falcon car (to which we referred on 14 July) would run for several years. But he was urged by the Detroit firm not to give publicity to the subject for the time being.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

5 Aug.—Romford B.C. Lighting included in private street works programme for (1) Parkland Ave and Lake Rise; and (2) Parkway.—See 21 July issue.

6 Aug.—Bacup B.C. Supply and erection of street lighting along 1·5 mile Todmorden Rd and 0·9 mile Booth Rd.—See 21 July issue.

8 Aug.—Greenock. (4) Electrical work in boilerhouse renewals at Ravenscraig Hospital. Applications to Secretary, Board of Management, Dykebar Hospital, Paisley, by above date.

8 Aug.—Lancs C.C. Rewiring of Darwen Spring View County School. Applications, reference A/G, to County Architect, P.O. Box 26, County Hall, Preston, by above date.

8 Aug.—Newbury B.C. Supply and erection of 30 140 W sodium lanterns to replace existing tungsten lanterns, moving of four steel columns and the erection of one new column.—Advertised 21 July issue.

8 Aug.—Romford B.C. Electrical installations in 24 flats and 16 houses, Waterloo Rd redevelopment. Borough Engineer and Surveyor, Town Hall. Deposit £2 2s.

8 Aug.—Watford B.C. Supply and erection of 93 sodium lanterns on concrete columns on North Orbital Rd, A405. Applications to Borough Engineer and Surveyor, F. C. Sage, Town Hall, by above date. Deposit £2 2s.

9 Aug.—Co. Londonderry. Electrical installation in new voluntary primary school at Swatragh.—See 21 July issue.

10 Aug.—Horncastle R.D.C. Provision and maintenance of two 104 g.p.m. vertical spindle pumps complete with motors, starters and accessories.—See 28 July issue.

10 Aug.—Surbiton B.C. Installation of 193 sodium and 270 colour-corrected mercury Group "A" lighting points.—See 14 July issue.

10 Aug.—Wortley R.D.C. Installation, complete, of colour-corrected mercury lighting: scheme 54, Ecclesfield bus route, 67 125 W on 20 ft columns; scheme 55, Stannington bus route, 60 80 W on 15 ft columns; scheme 57, Chapeltown to High Green, 74 125 W on 20 ft columns, scheme 58 (part), Chapeltown, 29 250 W on 25 ft columns.—See 14 July issue.

12 Aug.—Larne B.C. Electrical installations in: (a) shops and flats at Antiville; (b) 74 scheme of 50 dwellings; (c) 75 scheme for 52 dwellings.—See 7 July issue.

12 Aug.—Manchester C.C. Electrical installation in Whalley Range High School. City Architect, P.O. Box 488, Town Hall.

12 Aug.—Redcar B.C. Erection of Stanton columns and E.L.E. Co./G.E.C./Siemens-Edison Swan lanterns for 1960-61 programme.—See 28 July issue.

12 Aug.—Spenborough B.C. Electrical work in proposed Market Arcade, Albion St, Cleckheaton.—See 28 July issue.

12 Aug.—Ulster Transport Authority. Supply of (Contract 65) batteries and battery plates; (Contract 77) accessories, adaptors, plugs and switches; (Contract 78) Empire cloth, p.v.c. and cotton sleeving for year from 1 Oct., 1960.—See 21 July issue.

12 Aug.—West Riding C.C. (b) Electrical installation renewal in Fire Service H.Q., Oakroyd Hall, Birkenshaw. Applications to Divisional Architect, Flint St, Huddersfield, by above date.

15 Aug.—Birmingham C.C. Inspection and maintenance by passenger lift manufacturers of lifts on various flatted estates for 13 months.—See 21 July issue.

15 Aug.—Carlisle C.C. Electrical installations in 50 dwellings, Morton. City Engineer, 18 Fisher St.

15 Aug.—East Ham C.B. Supply and erection of (1) lighting columns, (2) street lighting equipment comprising 35 15 ft concrete and one 25 ft steel column together with lanterns, lamps and ancillary gear.—See 28 July issue.

15 Aug.—Wick T.C. Electrical work in erection of 92 houses in Willowbank sixteenth development.—See 21 July issue.

16 Aug.—Chesterton R.D.C. (a) Supply and erection of 260 15 ft concrete columns with 60 W sodium lamps/lanterns; (b) supply and erection of 95 15 ft columns with 100 W tungsten lamps/lanterns; (c) conversion of 320 c.i. gas columns for use with 100 W tungsten units; (d) dismantling of existing gas installation.—See 28 July issue.

16 Aug.—Islington B.C. Design, provision and installation of floodlighting at Market Rd playground.—Advertised 14 July issue.

16 Aug.—Lichfield C.C. Supply and installation of 26 Group "B" concrete columns with sodium lanterns/ancillary equipment and dismantling and re-erection of six c.i. columns along Weston Rd, Curborough Rd, etc.—Advertised 28 July issue.

17 Aug.—Moira R.D.C. Electrical work in 66 houses at Risk. Council Clerk, J. Deering, Sloan St, Lurgan.

18 Aug.—Cookstown. Electrical installation in hostel and extension at Loughry Agricultural for M. of Finance.—See 21 July issue.

18 Aug.—Sittingbourne and Milton U.D.C. Supply and/or erection of 112 Group "B" and eight Group "A" concrete columns with 80 and 250 W m.v. lighting. Engineer and Surveyor, Lydbrook, 89 London Rd, Sittingbourne. Deposit £2 2s.

19 Aug.—Coquet Water Board. Lighting, heating and power installations at new filtration works and pumping station at Warkworth. S. G. Barrett, Pilgrim St, Newcastle-on-Tyne.

19 Aug.—Manchester C.C. Electrical installation in workshop at Heaton Park. City Architect, P.O. Box 488, Town Hall.

19 Aug.—Pocklington R.D.C. Contract 2. Supply and erection at Melbourne of four 50 g.p.m. sewage ejectors complete with motors, starters and accessories.—See 28 July issue.

20 Aug.—Bournemouth C.B. Provision and erection of two 260 kW dual fuel alternator sets and associated switchgear for contract 3, Holdenhurst Sewage Disposal Works.—See 28 July issue.

20 Aug.—North Shields.—Rewiring of two wards at Preston Hospital.—See 21 July issue.

22 Aug.—Castlederg R.D.C. Supply and erection of 79 fluorescent lanterns, etc.—See 28 July issue.

22 Aug.—Chelmsford. Subcontract 16. Provision and installation of cables, external lighting, heating and lighting of buildings, power distribution and control equipment for extension 2 at Brookend Sewage Disposal Works.—Advertised 21 July issue.

22 Aug.—Ellesmere Port B.C. Provision and erection of 58 Group "A" columns, taking down 34 Group "B" columns and re-erection.—See 28 July issue.

22 Aug.—Enfield B.C. Section A: Supply of 316 140 W and 181 60 W integral jacketed sodium lamps, lanterns and gear. Section B: Supply of 316 25 ft and 181 15 ft concrete columns. Section C: Erection of columns/brackets/lanterns and removal of existing columns.—See 28 July issue.

22 Aug.—Frimley and Camberley U.D.C. Supply of 150 Group "A" steel columns. Engineer and Surveyor, Municipal Bldgs, London Rd, Camberley.—Advertised in this issue.

22 Aug.—Hendon B.C. Supply of (Item 6) electrical fittings for period to 30 Sept., 1961. Borough Engineer and Surveyor, Town Hall, N.W.4.

24 Aug.—Bridge-Bleau R.D.C. Supply of duplicate 75 g.p.m. against a 105 ft head vertical spindle direct coupled centrifugal sewage pumps for Tyler Hill scheme.—See 14 July issue.

27 Aug.—Staveley U.D.C. Supply and erection of 56 concrete columns, sodium lanterns, auxiliary gear and cable laying on A619, Worksop Rd. Engineer and Surveyor, Council Offices, Lowgates, Staveley, near Chesterfield.—Advertised in this issue.

31 Aug.—Renfrew T.C. Erection of alternative (a) 3 x 80 W fluorescent and (b) 400 W mercury schemes for A8 Inchinnan Rd street lighting improvements.—See 21 July issue.

31 Aug.—Wilton B.C. Installation of street lighting at Bulbridge Private Development Estate.—See 28 July issue.

1 Sept.—Dundee T.C. Supply and erection of multi-stage centrifugal pumps, acces-

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 97 queries answered this week

"Sorenson" constant voltage transformers—makers of? E.H.W.B.—J. Langham Thompson Ltd., 88 High Rd, Bushey Heath, Herts.

"Statotherm" energy regulators—makers of? G.V.—The Stabilag Co. Ltd., Mark Rd, Hemel Hempstead, Herts.

"Montgomery-Ward" auto-toasters—repairers of? E.T.—A. Aalbregt Electricals, 34 Ramsdale Cres, Sherwood, Notts.

"Fam" washing machines—makers of? L.E.B.—Couper Works Ltd., Wicklow, Ireland.

"Sims" travelling irons—makers of? E.E.—Henry Sims, 191 Goldhurst Terr, N.W.6.

"Centec" routing machines—makers of? T.E.—Central Tool and Equipment Co. Ltd., Centec Wks, Hemel Hempstead, Herts.

"Selecta" grinders—makers of? E.E.B.—B. Elliott and Co. Ltd., Victoria Wks, Victoria Rd, N.W.10.

"Elstein" sunlamps—agents for? M.I.E.—P. and R. Electrical Co., Pearl Hse, 1 Berrymead Gdns, W.3.

ANSWER WANTED

Three-position lever switch—"on/off/on" "dead man handle type" 2 amp rating, 50 V d.c.—makers of? D.R.L.

sories and switchgear for Menzieshill Pump Hse.—See 21 July issue.

1 Sept.—Farnborough U.D.C. Installation of 218 power points in 48 dwellings on Knellwood estate. Engineer and Surveyor, Municipal Offices, Alexandra Rd, Farnborough, Hants. Preference to contractors on N.I.C.E.I.C. roll.

1 Sept.—Kirkby-in-Ashfield U.D.C. Supply and installation of two 20 c.f.m. and one 35 c.f.m. sewage pumps and one 35 c.f.m. sludge pump complete with starters, switchgear, cables, etc.—See 28 July issue.

1 Sept.—Warrington R.D.C. Installation of 48 Class "B" street lighting units on A574, Warrington Rd, Risley.—See 21 July issue.

3 Sept.—Cambridge C.C. Supply of Item (d) lamps.—See 14 July issue.

5 Sept.—Manchester C.C. Supply and erection of lighting equipment/auxiliary services for primary sludge digestion plant. City Surveyor, Town Hall, Manchester 2.—Advertised in this issue.

10 Sept.—Waterford C.C. Supply of two 20 g.p.m. centrifugal pumps and motors for Kill and Bonmahon Water Supply Scheme.—See 28 July issue.

10 Sept.—Willenhall U.D.C. Erection of 92 Stanton 9A concrete columns and provision/fixing of 80 W mercury lanterns/lamps with necessary wiring. Engineer and Surveyor, Town Hall.

No date stated—Herefordshire C.C. Installation of 210 lighting units for traffic signs on Ross Spur Motorway.—See 28 July issue.

No date stated—Lanark. Electrical work in (a) Wards 7 and 8 and (c) Nurses' Home, phase IV, at Stonehouse Hospital.—See 21 July issue.

No date stated—Southampton C.B. Electrical and mechanical work in (a) electrical machines laboratory and (b) steam engines laboratory at College of Technology.—Advertised 14 July issue.

No date stated—S. Warwickshire Hospital Group. Applications invited for inclusion in approved list of electrical contractors.—See 14 July issue.

No date stated—Whitby U.D.C. Supply and erection of 117 Group "A" steel octagonal columns, five wall brackets, seven Group "B" steel columns with 250 W colour-corrected mercury and 80 W mercury fluorescent lamps/lanterns/control gear. Engineer and Surveyor, Council Offices, St. Hilda's Terr.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

15 Aug.—South Africa. 184 switch fuse units and 96 isolating switch units for 11 kV 250 MVA plus 16 ring main units and h.r.c. cartridge fuses. Town Clerk, Municipal Offices, Johannesburg. B.o.T. (ESB/18835/60).*

15 Aug.—Turkey. (1) Four 250 kVA and (2) two 350 kVA diesel alternator sets. Applications to M.S.B. N.A.T.O. Kara Enf. Grup. Bsk., Paris Cadd. 44, Kavaklidere, Ankara, by above date. B.o.T. (GD. 5695/58/17).*

17 Aug.—Burma. Three items: batteries of 100, each 12 V and 6 V, 19-plate and 21-plate. Director-General, Union of Burma Purchase Board, St. John's Rd, Rangoon. B.o.T. (ESB/19537/60).

18 Aug.—South Africa. 1,200 air-depolarised primary cells. Secretary, Union Tender Board, P.O. Box 371, Pretoria. B.o.T. (ESB/18698/60).*

19 Aug.—Costa Rica. Four items: 3-ph. starters for 15 to 75 h.p. motors. La Proveeduria Instituto Costaricense de Electricidad, San Jose. B.o.T. (ESB/19603/60/ICA).

23 Aug.—Greece. Distribution cable to value $1 million. The Greek Foreign Trade Administration, 2211 Massachusetts Ave, N.W. Washington 8, D.C., U.S.A. B.o.T. (ESB/19578/60/ICA).

24 Aug.—New Zealand. 1,200 yd 1·1 kV and 300 yd 11 kV single-core cambric insulated cable. Town Clerk, Town Hall, Wellington. B.o.T. (ESB/18864/60).*

25 Aug.—New Zealand. One 3-panel, 11 kV switchboard for alternatively 250 or 350 MVA. Town Clerk, Hamilton. B.o.T. (ESB/18613/60).*

26 Aug.—New Zealand. 24 each of 75 and 150 A two-way pair contactors; 24 each of 15 and 75 A t.p. contactors and four 200 A, 230 V contactors. Director-General (Stores Division), G.P.O., Wellington. B.o.T. (ESB/18850/60).*

30 Aug.—India. Meters and metering sets for use on voltages up to 22 kV. Superintending Engineer, Technical (Electrical), 157 Mount Rd, Madras 2. B.o.T. (ESB/18158/60).*

30 Aug.—India. 100 20 kVAr 230/400 V outdoor capacitors. Superintending Engineer, Technical (Electrical), 157 Mount Rd, Madras 2. B.o.T. (ESB/18688/60).*

31 Aug.—Portuguese East Africa. Four sectioning and transformation posts and one 100 kVA oil-immersed transformer. Ports, Railways and Transport Dept., Lourenco Marques. B.o.T. (ESB/19134/60).*

5 Sept.—Australia. 15 t.p. 132 kV, 7,500 MVA circuit-breakers and associated current transformers. Commercial Manager and Secretary, E.C. of N.S.W., Box 5257, G.P.O., Sydney. B.oT. (ESB/18686/60).*

5 Sept.—Thailand. 60 pole mounting capacitor banks. Commercial Dept., Metropolitan Electricity Authority, 121 Chakraphet Rd, Bangkok. B.o.T. (ESB/18678/60/DLF).*

14 Sept.—Kuwait. 33 kV and 11 kV power and pilot cables and accessories. Dept of Electricity, Water and Gas, Kuwait. B.o.T. (ESB/17149/60).*

15 Sept.—Australia. Four 6·6 kV switchboards complete for E.C. of Western Australia. Secretary, W.A. Government Tender Board, 74 Murray St, Perth. B.o.T. (ESB/19130/60).*

15 Sept.—India. 165 MVA transformers for Chandrapura Thermal Station of Damodar Valley Corpn. Tender Enquiry S.E.221, fee: £1 15s 9d, from India Store Dept., Bromyard Ave, W.3, viewing reference S.3245/60/NSC/ENG.2. B.o.T. (ESB/18137/60/DLF).*

16 Sept.—Chile. Centralised traffic control signalling system for Chilean State Railways. Sr Jefe, Depto de Materiales y Almacenes, Ferrocarriles del Estado, Estacion Almeda, Santiago. B.o.T. (ESB/1465/60).*

17 Sept.—New Zealand. Five mile 50 pairs and five mile 100 pairs p.v.c. insulated and sheathed telephone cable. Director-General (Stores Division), G.P.O., Wellington. B.o.T. (ESB/18852/60).*

18 Sept.—Iraq. Cables and accessories for Basrah. Inspectorate-General of Ports and Navigation, Ministry of Communications, Baghdad. B.o.T. (ESB/18478/60).*

20 Sept.—New Zealand. Three single phase 10,000 kVA transformers. Secretary, Tenders Committee, N.Z. Electricity Dept, Wellington. B.o.T. (ESB/17157/60).*

20 Sept.—New Zealand. 14 systems 24-channel voice frequency carrier telegraph systems. Director-General (Stores Division), G.P.O., Wellington. B.o.T. (ESB/18851/60).*

22 Sept.—Australia. Protective apparatus (21 items) including fuses, wire, mountings and arrestors. Details from Official Secretary for Australia, Australia Hse, Strand, W.C.2. B.o.T. (ESB/19121/60).*

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Ada. 784,845. Class 7. Drying, washing, wringing machines, etc. 784,846. Class 7. Domestic machines. Ada (Halifax) Ltd., West Mount Wks, Johnson St, Halifax.

Binson Echorec. 803,155. Class 9. Sound reproduction and amplification apparatus, etc. Modern Electrics (Export) Ltd., 164 Charing Cross Rd, W.C.2.

Cirtest. 800,171. Class 9. Circuit testing apparatus, etc. Hasler Telegraph Works Ltd., 26 Victoria St, S.W.1.

E.I.L. in design. B768,325. Class 9, Electronic measuring instruments. Electronic Instruments Ltd., Mortlake Rd, Richmond.

Helphos. 799,562. Class 11. Lamps, etc. Helphos Lamp Co., 5 Charles La, N.W.8.

Industrolite. B795,792. Class 11. Fluorescent lighting installations, etc. Industrialite Ltd., 52 Manor Rd, Wallington, Surrey.

Magidor. 803,390. Class 9. Apparatus for operating doors, etc. Kinetrol Ltd., Trading Estate, Guildford Rd, Farnham, Surrey.

Niplas. 803,340. Class 9. Cables. Greengate and Irwell Rubber Co. Ltd., Greengate Wks, Greengate, Salford.

Riviera. B797,939. Class 7. Sewing machines, motors, etc. Brother International Corpn. (Europe) Ltd., Santry, Dublin, Eire.

Siltal. 801,244. Class 11. All goods. Hamilton House Electrics Ltd., 544 Commercial Rd, E.1.

Style Mark in design. 793,482. Class 7. Machines for washing, drying, ironing and dishwashing. Kelvinator Ltd., New Chester Rd, Bromborough, Wirrall, Cheshire.

Titan. 795,106. Class 9. Electrolytic cells. Paterson Eng. Co. Ltd., 129 Kingsway, W.C.2.

CONTRACTS PLACED

Chester C.C. Supply and erection of 58 units, Plas Newton estate; gas replacement standards, Hoole; Class "A" lighting, Wrexham Rd. Erecon Ltd., £1,172, £1,585 and £1,331, respectively.

Consett U.D.C. Supply and erection of ten m.v. and 56 sodium vapour lanterns for Castleside Rd, Victoria St, Bertha St and Park Rd lighting improvement, General Electric Co.

Dorchester B.C. Supply of lanterns, brackets and lamps for Weymouth Ave/Trinity St improved lighting, General Electric Co., £1,019. Recommended.

Islington B.C. Electrical work at Halton Mansions, Evans and Shea Ltd., £13,304. Recommended.

Middlesbrough T.C. Electrical installation: in St. Hilda's C.E. School, J. Patterson and Co., £385; in Beechwood School, C. Horne and Co. Ltd., £1,346. Recommended.

Newcastle-on-Tyne C.C. Supply of 293 colour-corrected m.v. lanterns and control gear, General Electric Co., £3,635 12s 10d.

Sedgefield R.D.C. Electrical installations in: 60 houses, Robinson and Charlton; 16 houses, K Cartnell.

Skelton and Brotton U.D.C. Wiring of: 12 bungalows and 16 houses, Reeve and Coe; 14 houses, Tees-side Insulating Co.

Spenborough B.C. Supply and erection of 356 Group "B" concrete columns complete with lanterns / lamps / control gear / wiring, General Electric Co.

Tyldesley U.D.C. Supply and erection of 52 Class "B" and two Class "A" concrete columns with sodium lamps, Gallagher and O'Brien Enterprises Ltd.

Woolwich B.C. Electrical installations in 72 dwellings at Strongbow Rd, London Electricity Board, £13,100. Recommended.

TRADE NOTES

Change of Address. The Electropower Co. Ltd. has moved to Gatehouse Rd, Aylesbury, Bucks. Telephone: Aylesbury 4711.

Change of Name. Metropolitan-Vickers-GRS Ltd. has changed its name to Associated Electrical Industries-GRS Ltd.

BUSINESS PROSPECTS

Aberdeen. E. D. Jefferiss Mathew, 3 Ebury St, S.W.1, architect for £600,000 Natural Philosophy building for University.

Accrington. W. Hayhurst, Laund, plans private housing estate, eight acres, Laund Rd.

Ashton-under-Lyne. Park Sheet Metal Co., 114 Park St, Ashton, plan Hill St and Cavendish St sheet metal works.

Aspatria. John Twiname, Allerdale Hse, Brigham, plan 160 Brandrew houses.

Barrow-in-Furness. Russell Bros., Salthouse Rd, plan 14 Arundel Drive bungalows.—A. Whitehead plans 52 Dane Ave area houses.

Basingstoke. Hampshire C.C. plan enlargement of County High School for further 320 girls.

Bedlington. Thermalite Ytong Ltd., subs., John Laing and Son, Mill Hill, N.W.7, plan concrete factory, Cambois.

Birmingham T.C. Tender: Eight two-storey Gleve Farm Rd dwellings and garages on three other sites. Architect.—Ansells Brewery plan Shard End £70,000 premises. Architects' department, Phillips St, Birmingham 6.

Bolton. Whitakers (Bolton), 79 Deansgate, plan Old Hall St North land development.—Corporation Welfare Committee plans £64,350 Breightmet Laburnum Lodge hostel.

Bournemouth. £59,000 "Broom Close" home for the aged planned. Borough Architect.

Bracknell. E. A. Ferriby, Farley Hall, Binfield, architect for Ferranti's factory and offices.

Bradford. Scherrer and Hicks, 27 Harcourt Hse, Cavendish Sq, W.1, architects for 700-place school, South Bradford.

Brentford. J. Mendleson and Ptnrs, 71 Wimpole St, W.1, architects for R. B. Pullin and Co., Phoenix Wks, Gt. West Rd, £100,000 extensions.—Bernard Sunley Investment Trust, 25 Berkeley Sq, W.1, plan factory offices.

Brighton. Hammerson Group of Companies, Quadrex Hse, Park La, W.1, plan redevelopment of Albemarle Hotel for show basement, licensed premises, restaurant, shops with 48 flats in 13-storey building.

Burgess Hill. C. E. Ball and Ptnrs, 36 Fitzroy Sq, W.1, quantity surveyors for Glenview Estates Ltd. 36 flats.

Burton-on-Trent. B.C. recommends purchase of Hawfield La land for 30-place home.

Bury St. Edmunds. W. Suffolk County Health Committee plan £50,000 home, Hospital Rd.

Buxton. Derbys C.C. plans College of Further Education, Empire Hotel site.

Cambridge T.C. Tender: 11-classroom primary school, Histon Rd. Surveyor.—S. W. Appleyard and Ptnrs, 16 John St, W.C.1, quantity surveyors for *Cambridge Daily News* (1929) printing works in Newmarket Rd.

Cardiff. T. A. Lloyd and Gordon, 6 Cathedral Rd, architects for £100,000 Bowmaker (Plant) service and sales depot.

Carlisle. E. M. Lawson, Barras Bldgs, Barras Bridge, Newcastle, architect for Durranhill industrial estate TV centre, Border Television Ltd.

Carlton U.D.C. Tender: 24 Phoenix Farm estate houses, Site 36, Scheme 91. Engineer.

Chelmsford. Cooper Estates, Wilmington Hse, Wilmington, Kent, plan 36 Beech's Brickfields houses.—Duncan Cameron and Hutchinson, Barclays Bank Chmbrs, Rayne Rd, Braintree, plan two blocks five terraced houses.—W. Goodchild and Co., 123 South St, Romford, Essex, surveyors for Mulsham Development 347 houses and garages.

Cheltenham. Kingsgate Investment Co., 11 Park Pl, S.W.1, plan 140 flats, Coronation Sq.—Marshall's (Charlton Kings), Orchard Priors, plan 11 bungalows and three houses, Oakland Court site, Prestbury Rd.

Cockermouth. Millers (Gt Yarmouth), Derwent Mi'ls, plan factory extensions.

Coventry. G. R. Stone, of Coventry, designer of £450,000 project providing 11-storey block and five buildings containing 55 maisonnettes on site opposite Coventry Memorial Park.—T.C. plan £49,500 home, Quinton Park.

Croydon. Tamworth Park Construction Co., 2 Thrale Rd, Streatham, S.W.16, plan 34 flats on 3 Mowbray Rd.—M. J. Gleeson (Contractors), London Rd, North Cheam, Surrey, to build 12 maisonnettes, Teevan Rd and Blackhorse La.—Lawdon Developments, 157 Victoria St, S.W.1, plan 66 flats, Addiscombe Rd, etc.

Dartford. Roman Catholic Diocese of Southwark plan St. Vincent School, Temple Hill, extensions.

Eastbourne. 50-place home, Seaside, planned by M. of Health.

East Suffolk C.C. Tender: Stowmarket Primary School additions. Architect.

Falkirk. British Aluminium Co., Norfolk Hse, St. James's Sq, S.W.1, plan £213,000 Bainsford factory extensions/alterations.

Felling. Alnwick Construction and Engineering Co., Alnwick, Northumberland, contractors for Hackbridge Cable Co. warehouse and offices, Cross Row.

Fife. Henry Balfour and Co. plan £280,000 Leven extensions.—Enamelled Metal Products Corpn. (1933) Durie Foundry plan £80,000 extensions.

Gateshead. Corporation Children's Committee plans £60,000 remand home, Penshaw Hse Nursery. Borough Engineer.

Glasgow. McCullum and Mackie, 97 Wellington St, C.2, on behalf of Toffolo, Jackson and Co., plan Burnfield Rd area factory.—Town and City Properties Ltd., Ormonde Hse, St. James's St, S.W.1, plan shops and houses, Gt. Western Rd, W.3.—R. F. Black and Assoc., 9 India St, C.2, architects for Commercial and General Investments Cambridge St shops.

Greenwich B.C. Tender: New Brook La, Branch Library, Kidbrooke, S.E.3. Engineer.

Guernsey. Guernsey Contractors to build £148,000 St. Peter's Port six-storey shop and offices for Island Properties.

Hastings. Thornburn, Muirhead and Ptnrs, London, plan 124 flats and restaurant, car park and petrol station on Grand Hotel site.

Hereford. Harry Bloomer and Son, 73 Hagley Rd, Five Ways, Birmingham, architects for Corporation's abattoir.

High Wycombe. Thurlow, Lucas and James, 86 Easton St, architects for £50,000 Avon Rubber Co.'s factory and offices.

Hornsey B.C. Tender: 53 flats and maisonnettes on two sites in Campsbourne redevelopment area. Stage IV of scheme. Engineer.

Horsham. Godman and Kay, 13 North Parade, architects for £150,000 81-flat plan, The Bishopric, for Watt Settlement Trust.

Hove. Morgan and Carn, 12 Grand Ave, architects for Kingsway Hotel site block of flats.

Ipswich BC. Tender: Heathside Training Centre, Heath Rd. extension. Engineer.—Vine and Vine, Tudor Chmbrs, Station Rd, N.22, architects, Civic Centre scheme.

Kingswood U.D.C. Tender: 12 houses and eight bungalows. Hollies Cres. Clerk.

Leeds. Sir Lindsay Parkinson and Co., Templenewsam, plan 67 Westwood La flats.

Leicester. Administrative C. Tender: Residential hostels, Loughborough College. County Architect.

Lincs. Fisons Ltd. plan Immingham factory extensions.

Littlehampton. Ortem Estates, Kensal Hse, Harrow Rd, W.10, plan Surrey Hse site blocks of flats.

Liverpool. J. and P. Jacobs Ltd. plan Paula Works extensions, Charnock Rd.—Teachers' Training College, Taggart Ave, planned by College Council.—J. W. Jones and Sons Ltd., 158 Allerton Rd, plan 14 houses and 11 flats, Woolton Rd, Garston.

London.—Donaldson and Son, 17 Dalston La, E.8, surveyors for Gt. Eastern St warehouse.—Fewster and Ptnrs, 22 Conduit St, W.1, architects for Coldharbour La, S.E.5, warehouse.—R. H. McEwan, 10 Carteret St, S.W.1, quantity surveyor for £120,000 rebuilding of Heathfield Rd warehouse for Army and Navy Stores.—H. Williams and Ptnrs, 80 High St, Croydon, surveyors for Reynard Mills site factory, Windmill Rd, W.4.—D. Harwin and Ptnrs, 776 High Rd, N.12, quantity surveyors for King George's Hall, East India Dock Rd, E.14, hostel.—W. J. Perkins and Ptnrs, consulting engineers for £289,433 Billingsgate Market Improvement Scheme.—Commercial and Industrial Structures, 77 George St, W.1, plan Chiswick High Rd offices.—Capital and Counties Property Co., 4 Lloyds Ave, E.C.3, promoters of £200,000 scheme for shops and flats, New Lowndes St, S.W.1.—Clive Pascall and Peter Watson, 24 Half Moon St, W.1, architects for Vauxhall Bridge Rd premises, offices, flats.—A. R. Clare, High St, Pinner, Middx, plans Aldrington Rd, Wandsworth, flats.—Harvey Struth and Co., 77 George St, W.1, surveyors for Keswick Rd flats.—J. E. Fisher and Son, 968 Gatton La, S.W.17, surveyors for North End Rd, S.W.6, offices and residence accommodation.—Stafford and Pollard, 24 Princes St, W.1, architects for 11-storey block shops, West London.—The Design Group, Suite 10, 1-11 Hay Hill, W.1, architects for 100 Priory La, Roehampton, flats for Norman Property Co.

Luton. Traherne Holdings plan 60 Pembroke Ave area flats.—Claydon Securities Ltd. plan 15 blocks of flats between Birchen Grove and Felstead Way.

Manchester. Industrial Cooling Equipment, 123 Liverpool Rd, Manchester, plan factory extensions.—Tizer Ltd., 270 Lightbowne Rd, Manchester 10, plan factory extensions. — Freeholds and Leaseholds (Manchester) plan 35 Dene Rd flats, Didsbury.—Bentley Building Co., 16 Clegg St, plan 16 Spath Rd flats.

Middlesbrough C.C. Tender: Stainsby Sec. School, 8,500 sq ft. Education Architect.

Monmouth. Davis, Bellfield and Everest, 9 Ashley Pl, S.W.1, quantity surveyors for Caerleon Training College planned by C.C.

Morecambe and Heysham. A. Robinson and Sons, West End Rd, plan 23 Lonsdale Ave bungalows.—J. Parkinson and Sons, Parliament St, Lancaster, plans 43 Fulwood Drive, etc., bungalows.

Newbury. The Shilston Construction Co., Knightsbridge, Headley, Oxon, plan 20 Courtlands Estate, Pyle Hill, dwellings.

Newcastle. Education Committee tender: Further extensions and alterations at Heaton Grammar and High Schools. City Architect.—Stage 5, Rutherford College of Technology planned (City Architect), and College of Further Education, St. Mary's Pl (W. B. Edwards and Ptnrs, 5 Claremont Bldgs).—M. and H. Gatoff, 26 Mosley St, architects for Hutchinson and Co.'s factory and office building, Duke St.

Newport. Welfare Committee plan £92,250 Gaer Rd two-storey home.

Norfolk C.C. Welfare Committee plan £71,000 Aylsham home.

N. Riding C.C. Collins, Melvin Ward and Ptnrs, 5 Manchester Sq, W.1, architects for Cleveland Tech. College final stage.

North Wales. Ferodo, Chapel-en-le-Frith, Derbys, plan Caernarvons factory at £3 million.

Paisley. A. Stoddart and Co., St. Mirren Works, plan £25,000 Wellington St factory.

Rochester T.C. Tender: 62 Troy Town Redevelopment area flats. Surveyor: J. A. Peel, 66 Maidstone Rd.

St. Helens B.C. Tender: 24 Houghton Rd bungalows. Engineer.

Salford. *The Guardian* and *Evening News* Co., 3 Cross St, Manchester 2, to buy three plots land, Yorkshire St area.

Southall. Middx C.C. Welfare Committee plan £79,070 Bridge Rd home.

Southport. Howard Estates, 9 Queens Rd, plan 55 dwellings and shops, Merepark Drive, Dock La, etc.

Business Prospects continued

S. Shields. G. Wilson, Bedesway, plan plating shop.

Stafford. Sir Lindsay Parkinson and Co., 6 Lambeth Rd, S.E.1, contractors for £450,000 College of Technology, Weston Rd, for C.C.

Staffs. County Health Committee plan two hostels, Rodbaston, and £30,000 Leek training centre.

Stockton-on-Tees. J. T. Bell and Son, Market St, plan £1¼ million 650-house scheme on 60-acre Harrowgate La site.

Stoke-on-Trent. G. Percy Trentham, Park Hall Depot, contractors for £38,000 warehouse at Myott Son and Co.'s Alexander Pottery.

Sunderland R.D.C. 100 bungalows planned on various sites. Surveyor, Esplanade.

Tottenham B.C. Tender: 76 Warwick Gdns, etc., dwellings. Engineer.

Tralee. Tender: Factory for Kingdom Tubes. A. G. Jennings, O'Connell St, Sligo, Consulting Engineer.

Wakefield. Kay Hartley and Waite, 4 Crown Ct, architects for Harrap Bros. (Sirdar Works) canteen, spinning shed extensions, warehouse, etc., Bective Mills.

Wandsworth B.C. Tender: 10 Prescott Pl houses. Engineer.

W. Kesteven R.D.C. Tender: 28 houses and bungalows, three sites. Surveyor.

Wilton. I.C.I. plan £10 million extensions.

Whitley Bay. Gordon Durham and Co. East Boldon, Co. Durham, contractors for Foxhunters estate bakery extensions for Wilson's Edinburgh Bakeries.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

A. and B. Accessories (Lancaster) Ltd., 5 Great John St, Lancaster. To take over the business of wholesale factors to the motor, electrical engineering and allied trades carried on by John Allison and Reginald Butters at Lancaster, as "A. and B. Accessories," etc. Nom. cap.: £4,000. Dirs.: John Allison and Reginald Butters.

Anglo Carbon and Contacts Ltd. Mechanical, electrical and general engineers, etc. Nom. cap.: £5,000. Dirs.: To be appointed by subs. Subs.: J. Wray and Mrs C. Wray, 14 Hillfoot Dr, Pudsey, Yorks.

Atlantic Electronics Ltd. Nom. cap.: £1,000. Dir.: Zbigniew J. Golebiowski. Subs.: Geo. A. Crook, 51 Caversham Ave, N.13, and Emily Faulkner, 15-17 Chichester Rents, W.C.2.

Blackford and Bell Ltd., 141 Stamford Hill, N.16. Manufacturers of and dealers in vacuum cleaners, etc. Nom. cap.: £1,000. Dirs: Donald Blackford and James A. Bell.

Brockway Bros. Ltd., 28 Partridge Rd, Roath, Cardiff. Electrical installation contractors, plumbers, etc. Nom. cap.: £1,000. Joint permanent managing dirs.: James T. Brockway and Frederick A. Brockway.

Cannon Electronics and Automation Ltd., 60 Bullsmoor La, Enfield, Middx. Nom. cap.: £100. Dirs.: Edgar D. Cannon and Mrs D. G. F. Cannon.

Cooper Electroheat Ltd., 164 Lord St, Southport. To take over the business carried on by Peter J. Cooper at 29 Park Cres, Southport, etc. Nom. cap.: £5,000. Permanent dirs.: Peter J. Cooper and Muriel Cooper.

Combined Telephone Holdings Ltd. Nom. cap.: £100. Dirs.: not named. Subs.: David H. Tate, 18 Austin Friars, E.C.2, and G. G. Williams.

Cope and Cope (Exports) Ltd., 21 Clifford St, W.1. To carry on the export business hitherto carried on by British Livestock Exports Ltd., of 21 Clifford St, W.1, and Cope and Cope Ltd., of 57 Vastern Rd, Reading, as dealers in and sellers of agricultural, farm and allied machinery and equipment, etc. Nom. cap.: £5,000. Dirs.: To be appointed by subs. Subs.: J. H. Cotton and C. N. Stanford.

F. and C. Distributors (Ealing) Ltd., 267 Northfields Ave, W.5. Manufacturers, distributors and dealers in electrical equipment, etc. Nom. cap.: £100. Dir.: Albert W. Froud.

Froster Industries Ltd., 8-16 Park St, Bristol 1. Manufacturers' agents in respect of refrigerators, air conditioning, drying, washing, heating and ventilating plant and machinery, etc. Nom. cap.: £1,000. Dirs.: To be appointed by subs. Subs.: Anthony N. Church and Douglas H. Poole.

Grants (Gloucester) Ltd. Manufacturers of and dealers in sewing machines and other electrical goods, etc. Nom. cap.: £5,000. Permanent dirs.: John Grant and Mrs Doralais I. Grant, 23 Central Rd, Gloucester, and Ronald J. Edwards.

Heledon Domestic Electrical Supplies Ltd., 170 St. Paul's Rd, N.1. Nom. cap.: £200. Dirs.: Ivan R. Sutton and Helen G. Calderwood.

J.P. Electrical Contractors Ltd., 31 Essex Rd, N.1. Nom. cap.: £1,000. Dirs.: John A. Phillips and Edward G Latham.

H. Kuhnke Ltd. Dealers in, importers and exporters and manufacturers of, electrical apparatus, etc. Nom. cap.: £1,000. Dirs.: To be appointed by subs. Subs.: Geraldine Silver, 16 Lawrence Ave, E.12; and Wm. Mason.

Lumatic (Installations) Ltd., 47 South St, Epsom, Surrey. To carry out all the installation work at present undertaken by Lumatic Ltd. Nom. cap.: £100. Dirs.: Robert W. Travis, Irene Travis and William Kidd.

Metal Lighting Columns Ltd., 54 Wheeleys Rd, Edgbaston, Birmingham 15. To design and manufacture lighting columns, etc. Nom. cap.: £1,000. Dirs.: Reginald D. Weatherell and John Lowe.

Pannumatic Ltd., 85 Harrow Rd, W.2. Dealers in electrical and domestic articles, etc. Nom. cap.: £1,000. Dirs.: Joseph W. Creedy and Graham Webb.

A. J. Place (Wholesale) Ltd., 1 Westgate, Southwell, Notts. Electrical goods wholesalers, distributors and manufacturers, etc. Nom. cap.: £1,000. Dirs.: Alexander J. Place and Mrs Joan Place.

Sphere Audios Ltd., 26 Fulham Palace Rd, W.6. Manufacturers of and dealers in electrical goods, etc. Nom. cap.: £100. Dirs.: Leslie Levy and Mrs Hetty L. Levy.

Tellurometer (U.K.) Ltd. Manufacturers of instruments, machinery, materials and devices for nuclear, atomic and electronic purposes, etc. Nom. cap.: £1,000. Dirs.: not named. Subs.: H. Wright, 19 Stockton La, York; and Commander R. Bill.

Victor Installations Ltd., 6 Surrey St, W.C.2. Electricians, etc. Nom. cap.: £100. Dirs.: To be appointed by subs. Subs.: Stanley H. Lucas and Francis A. Dean.

Visual Engineers Ltd., Paxton Hse, 36-38 Dean St, W.1. Nom. cap.: £2,000. Manufacturers of and dealers in radio, electrical, electro-mechanical and electronic equipment, etc. Dirs.: Francis N. V. Ernst and Eric A. Major.

S and S Wholesale (Midlands) Ltd., 51 East Bond St, Leicester. Electrical engineers, etc. Nom. cap.: £1,000. Dirs.: Reginald C. Spencer and Dorothy M. Spencer.

Gazette Announcements

BANKRUPTCY ACTS

Receiving Orders

Burnley. E. H. Thornton, electrical engineer, formerly carrying on business as Thornton's Electrical Services, at 17 Hebrew Rd, Burnley. Receiving order dated 20 July.

Manchester. P. G. Miller, electrical engineer, formerly carrying on business at 2 Laurel Grove, Withington. Receiving order dated 21 July.

Oldham. Wards Electrics, electrical goods retailers, carrying on business at 64 Bottom o' the Moor, Oldham, and at 106 Glodwick Rd, Oldham. Receiving order dated 21 July.

First Meetings and Public Examinations

High Court of Justice. J. R. McRae, electrical dealer, carrying on business as J. R. M. Televisions at 3 Evelyn Drive, Hatch End, Pinner, and lately at 13 Wigton Gdns, Stanmore. First meeting: 12 noon 4 Aug. and public examination: 11 a.m. 7 Oct. both at Bankruptcy Bldgs, Carey St, W.C.2.

Guildford. G. R. Jacobs, television, radio and electrical appliance retailer, carrying on business as Dawn Electric Appliances at 192 Stoughton Rd and formerly at 226 Connaught Rd, Brookwood. First meeting: 11.30 a.m., 9 Aug., at 58-61 York Terr, Regent's Pk, N.W.1, and public examination: 10.45 a.m. 4 Oct. at The Guildhall, Guildford.

Appointment of Trustee

Sheffield. J. Crampton, electrical retailer, carrying on business as Grosvenor Electrics at 125 Frederick St, Rotherham, and formerly at 97 Mary St, Sheffield, and previously in partnership as Grosvenor House Electrical Products at 147 Askern Rd, Bentley, Doncaster, and at Rotherham. Mr P. Cardwell, 93 Queen St, Sheffield 1, appointed trustee as from 20 July.

Intended Dividends

Truro and Falmouth. G. B. Solomon, radio and electrical dealer, carrying on business as St. Columb Radio at 57 Fore St, St. Columb. Last day for receiving proofs for intended dividend: 9 Aug., to trustee, J. E. Ellis, 50 The Terr, Torquay.

Brighton. F. W. Ames, electrician, of 73 Havelock Rd, Bognor Regis. Last day for receiving proofs for intended dividend: 10 Aug. to trustee, T. H. Parker, 8 Old Steine, Brighton 1.

COMPANIES ACTS

Birmingham Electronic Products Ltd. Creditors to send details to liquidator, W. Le'Resche Hand, Colmore Hse, 21 Waterloo St, Birmingham 2, by 31 Aug.

Electronic Services (Staines) Ltd. Mr G. A. Wale, Walter Hse, 418-422 Strand, W.C.2, appointed liquidator at extraordinary general meeting on 14 July for the purpose of winding up.

Yarworth Electric Panel Co. Ltd. General meeting of members to be held at 12 noon on 27 Aug. at 90 Liddell Gdns, N.W.10, to receive the account of the liquidator.

Electronic Mnfg. and Development Co. Ltd. Liquidator: P. Cardwell, 93 Queen St, Sheffield, released as from 3 May.

Lee Electrohomes Ltd. Creditors to send details to liquidator A. W. Hunter, Walter Hse, 418-422 Strand, W.C.2, by 5 Aug.

Whitetrade Ltd. Winding-up order dated 20 July.

Voluntary Liquidation

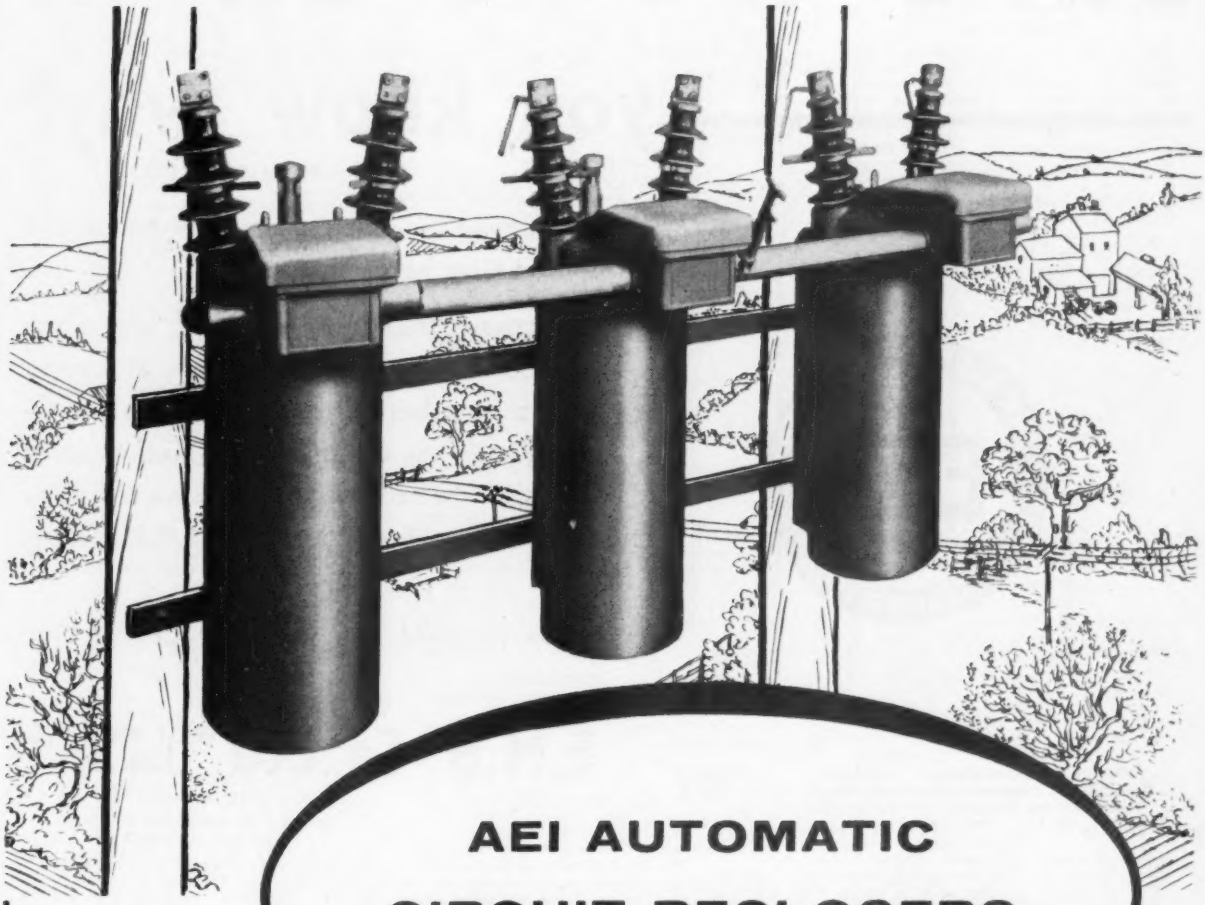
County Electronics Markfield Ltd., radio, television and electrical engineers.

The statement of affairs presented at a recent meeting of creditors disclosed liabilities £2,255, while assets, after allowing for preferential claims, were estimated to realise £365, leaving a deficiency of £1,890. The company, issued capital £500, was registered in January, 1958, and took over an existing business which the first year resulted in a net loss of £479 on a £4,500 turnover, with a similar loss the following year. The period 1 Jan., 1960, to 13 July showed a further net loss of £738.

The position was attributed to shortage of working capital and insufficient turnover.

Creditors passed a resolution confirming the voluntary winding-up of the company with Mr R. A. Haigh, A. C. Palmer and Co., Court Chmbrs, Friar La, Leicester, as liquidator, with a committee of inspection.

• • • Keep supply lines clear



AEI AUTOMATIC CIRCUIT-RECLOSERS

PERFORMANCE DETAILS

SUPPLY: *Up to 11-kV*

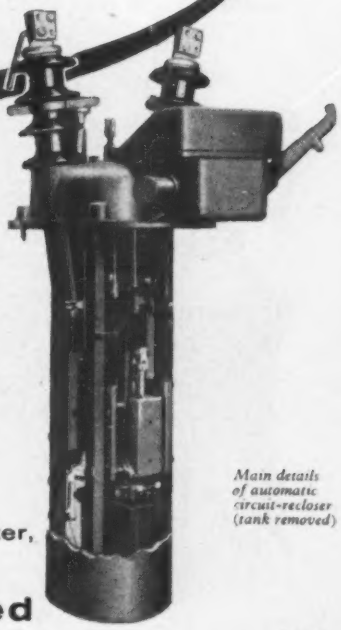
BREAKING CAPACITY: *Up to 75 MVA*

CURRENT RATING: *5 to 200 amperes*

DUTY CYCLE: *2 instantaneous or 2 time-delayed trips, and 4 instantaneous trips*

Automatic Circuit-Reclosers Type RB from AEI prevent transient faults from causing lengthy supply interruptions on rural lines. Experience has also proved that on lines protected by these reclosers, the number of persistent faults is considerably reduced.

For further details, write to AEI Switchgear Division, Willesden Works, Neasden Lane, London, N.W.10 or to your local AEI office.



Main details of automatic circuit-recloser (tank removed)

AEI

Switchgear Division

Willesden, London · Trafford Park, Manchester, Higher Openshaw, Manchester

Associated Electrical Industries Limited

F/A911

sure we're sure!

——————you know why?

We thoroughly—repeat thoroughly—test all our Control Gear before dispatch !

For instance, take this equipment with three MICROsens for a Carruthers crane at London Airport. We had to make 204 separate connections just for the test, but having made it, we're dead sure the set will give the same reliability which is always associated with E.M.B. Control Gear.

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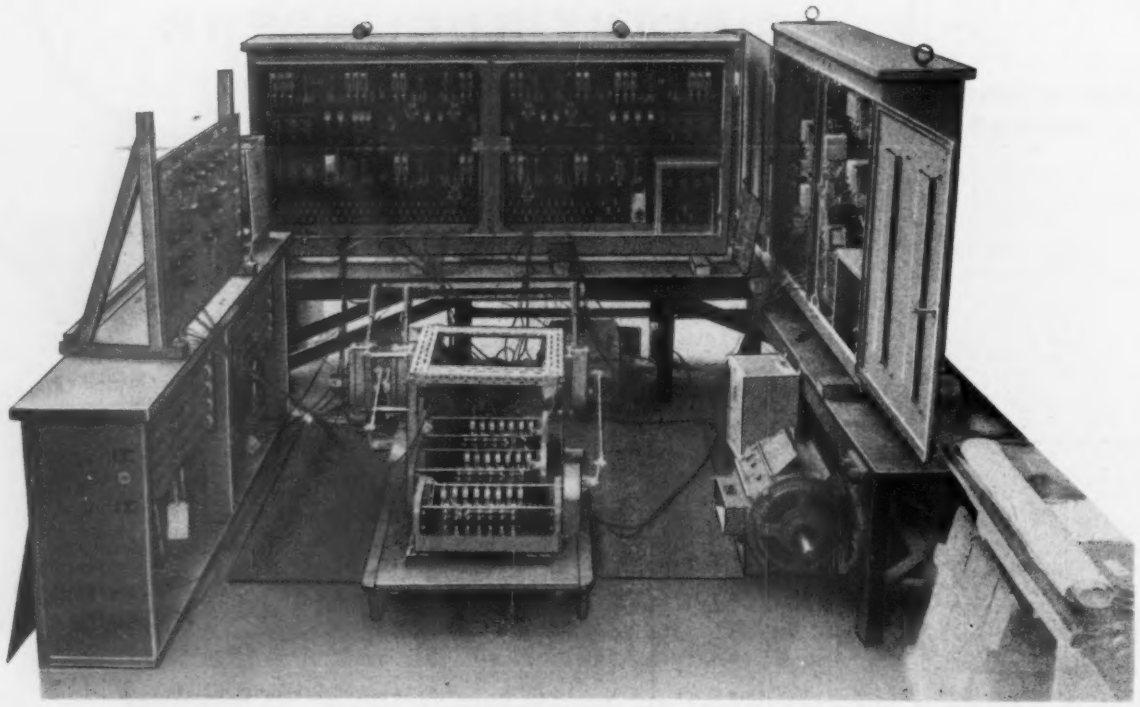

CLASSIFIED ADVERTISEMENTS

TENDERS INVITED

CITY OF MANCHESTER
Davyhulme Sewage Works Extensions

TENDERS are invited for the supply, delivery and erection of the lighting equipment and auxiliary services for the Primary Sludge Digestion Plant.

Tender documents, to be returned by 9.30 a.m. on 5 Sept., 1960, obtainable after 15 Aug., from the City Surveyor, Town Hall, Manchester 2. (R 569)

FRIMLEY AND CAMBERLEY URBAN DISTRICT COUNCIL
Street Lighting—Supply of Columns

TENDERS are invited for the supply of approximately 150 Group "A" steel street lighting columns.

Specification and Form of Tender may be obtained from the Engineer and Surveyor, Municipal Buildings, London Rd, Camberley.

Tenders are to be delivered to the undersigned in plain sealed envelopes not later than first post on Monday, 22 Aug.

The Council does not bind itself to accept the lowest or any tender.

K. S. HARVEY,
Clerk of the Council.

Municipal Buildings,
London Road,
Camberley,
Surrey. (R 571)

STAVELEY URBAN DISTRICT COUNCIL
Tenders for Group 'A' Lighting Scheme in Sodium

TENDERS are invited for the supply and erection of approximately 56 complete lighting installations, including concrete columns, lanterns, auxiliary gear, cable laying, etc., on the main A.619 Worksop Rd, in the Urban District.

Forms of tender, specification, bill of quantities and conditions of contract (the Institution of Electrical Engineers model form) are obtainable from the Engineer and Surveyor and the plan may be inspected at his office, Council Offices, Lowgates, Staveley, Nr. Chesterfield.

Tenders endorsed "Worksop Road Lighting Scheme" must be sent so as to reach me not later than Saturday, 27 Aug. The Council do not bind themselves to accept the lowest or any tender.

HAMILTON H. STANLEY,
Clerk of the Council.

26 July, 1960. (R 570)

APPOINTMENTS VACANT

SOUTH OF SCOTLAND ELECTRICITY BOARD
Fife Area

SURVEYOR

APPLICATIONS are invited for the post of Surveyor with the Construction Department at East Port, Dunfermline. Applicants should have a varied experience of all types of overhead line construction up to and including 33 kV.

N.J.B. conditions apply. Salary: Schedule D, Grade 6, £620 x £20—£740 per annum.

Applications on standard form obtainable from Area Manager, S.S.E.B., East Port, Dunfermline, should be returned to him not later than Friday, 19 Aug., 1960. (R 554)

CENTRAL ELECTRICITY GENERATING BOARD
Eastern Division

APPLICATIONS are invited for the following appointment:—

GENERAL ASSISTANT ENGINEERS
GOLDINGTON GENERATING STATION
(BEDFORD)
(S.V. No. 1377)

Salary: N.J.B., Class H, within the range of Grades 16/14, £550/£725 per annum plus £90 per annum Shift Allowance whilst engaged on shift duties.

Duties include assisting in the Electrical Control Room and experience in the technical operation of electrical, boiler house, and turbine house plant, testing, etc., in a Generating Station and provide a suitable basis for promotion to higher technical grades.

Manual Workers in skilled grades with suitable technical training will be considered. Previous experience in a Generating Station and/or technical training to the standard of Ordinary National Certificate or its equivalent will be of advantage.

Applications, quoting S.V. Number 1377, stating age, qualifications, experience and present position should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Pl, Chalk La, Cockfosters, Barnet, Herts, by 13 Aug., 1960. (R 555)

SOUTH OF SCOTLAND ELECTRICITY BOARD
Ayrshire District

GENERAL ASSISTANT DISTRICT ENGINEER
ARDROSSAN

APPLICATIONS are invited for the above superannuable post.

Applicants should preferably possess a National Certificate in Electrical Engineering and have had experience in overhead and underground systems up to 33 kV.

The salary for the post will be in accordance with the N.J.B. Agreement, Class F, Grade 11, £690/£785 per annum.

Applications should be sent to the Area Manager, Mr G. F. Moore, not later than 22 Aug., 1960.

Greenholm St,
Kilmarnock. (R 580)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for superannuable posts as First Assistant, Second Assistant and Third Assistant District Engineer in the South East District of the Birmingham and District Sub-Area. Extensive experience necessary with high voltage, medium voltage and protective systems. Applicants should have technical qualifications commensurate with eligibility for Associate Membership of the I.E.E.

Salary ranges:

FIRST ASSISTANT DISTRICT ENGINEER
£1,340/£1,515 per annum (N.J.B. Grade J.4).

SECOND ASSISTANT DISTRICT ENGINEER
£1,080/£1,215 per annum (N.J.B. Grade J.7).

THIRD ASSISTANT DISTRICT ENGINEER
£950/£1,055 per annum (N.J.B. Grade J.9).

Apply, by letter, within 14 days, stating age, experience, qualifications, present position and salary to Emil Braathen, Sub-Area Manager, Midlands Electricity Board, 14 Dale End, Birmingham 4.

F. W. CATER,
Secretary.
(R 575)

SOUTH OF SCOTLAND ELECTRICITY BOARD
Glasgow Area

APPLICATIONS are invited for the following superannuable appointment in the Area Engineer's Department.

SECOND ASSISTANT DISTRICT ENGINEER
(EASTERN DISTRICT)

Candidates should have a sound engineering training with subsequent experience in the operation and maintenance of large distribution systems at voltages up to and including 33 kV. Experience in the planning and preparation of schemes for new development and network reinforcement together with construction work would be an advantage.

The possession of qualifications leading to graduate membership of the Institution of Electrical Engineers is desirable.

The successful candidate will require to reside within reasonable distance of headquarters, situated at 348 Duke St, Glasgow E.1.

Salary: £950/£1,055 per annum in accordance with Class G, Grade 7, of the National Joint Board Salary Scales.

Applications, quoting reference No. GE/1/60 to be completed on the standard Form A.E.6, obtainable from the Area Secretary and returned not later than four weeks from the appearance of this notice to 75 Waterloo St, Glasgow C.2.

A. KELSO,
Manager.
(R 579)

YORKSHIRE ELECTRICITY BOARD
No. 5 (Wakefield) Sub-Area

THIRD ASSISTANT ENGINEER
(CONSTRUCTION)

APPLICANTS should have had a sound practical training and experience in the construction, operation and maintenance of H.V. and M.V. overhead and underground distribution networks, substation plant and ancillary equipment. Experience in 33 kV and in 66 kV construction work and primary substation construction will be of advantage.

Applicants should have obtained the Higher National Certificate in Electrical Engineering or equivalent qualifications.

Salary: N.J.B. Class L, Grade 10 (Scale 10), £1,010/£1,130 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Rd, Wakefield, not later than 19 Aug., 1960. (R 578)

THE NORTH EASTERN ELECTRICITY BOARD
Chief Commercial Officer's Department, Carliol House

APPLICATIONS are invited for the following appointment:

SALES STAFF TRAINER

Applications are invited from persons having the ability to give instruction in sales technique to employees engaged in selling electrical appliances. Applicants should have had experience in retail selling and/or a wide experience in sales training. The person appointed will be expected to assist in the administrative arrangements and development of sales training courses and instruct at basic courses in salesmanship and more specialised courses on different types of appliances. The possession of an O.N.C. in Electrical Engineering or a City and Guilds Installation Certificate would be an advantage.

Salary will be in the range of £1,250/£1,350 according to qualifications.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box 117, Carliol Hse, Newcastle upon Tyne, within ten days of the date of this advertisement. (R 576)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 40s. per inch, and all other classified advertisements at 3s. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

THE NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:

Chief Engineer's Department
Operation and Maintenance Section, Carliol House

SENIOR ASSISTANT ENGINEER

To take charge of Electrical Plant Repairs sub-section. Applicants should be suitably qualified electrical engineers with extensive experience in testing, repair and maintenance of heavy electrical plant, including all classes of high voltage switchgear and transformers. Salary: Schedule B, new Class AX, Grade 1, £1,600/£1,870. N.J.B. conditions.

SENIOR ASSISTANT ENGINEER

To take charge of the Communications sub-section. Applicants should be suitably qualified telecommunications engineers with extensive experience in all branches of communications engineering, including telephony, selective control equipment and V.H.F. radio. Salary: Schedule B, new Class AX, Grade 1, £1,600/£1,870. N.J.B. conditions.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box 117, Carliol Hse, Newcastle upon Tyne, within ten days of the appearance of this advertisement. (R 577)

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

VACANCY No. 168/60T.

FOURTH ASSISTANT ENGINEER
(COMMUNICATIONS) EAST GRINSTEAD

APPLICANTS should have experience of the construction and maintenance of automatic telephone systems and of telephone line transmission equipment, with the Post Office or with a manufacturer. The successful applicant must be prepared to live in East Grinstead or in the immediate vicinity.

Salary: Class BX, Grade 11, £735/£990, or Grade 9, £840/£1,130, according to qualifications and experience.

Applications giving age, details of experience, qualifications, etc., and quoting vacancy number, should be sent to the Personnel Officer, Central Electricity Hse, Lower Ham Rd, Kingston upon Thames, Surrey, to arrive by 18 Aug., 1960.

W. H. DUNKLEY,
Divisional Controller.
(R 581)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Chilterns Sub-Area

SUB-AREA HEADQUARTERS, BEDFORD
FOURTH ASSISTANT ENGINEER
(PLANNING AND DEVELOPMENT)
194/60.R.ET.

Candidates should have had a sound technical training and experience in the planning and construction of large urban and rural distribution systems, including substations, at voltages up to 11 kV.

Salary: N.J.B. Class L, Grade 13 (£845/£930).

Apply by letter to the Manager, Chilterns Sub-Area, Eastern Electricity Board, Prebend St, Bedford, by 19 Aug., 1960, quoting the above reference number in full.

LUTON DISTRICT
DISTRICT COMMERCIAL ENGINEER
195/60.R.

The successful candidate will be responsible to the Manager of the District for all commercial aspects of a large District having an important industrial, agricultural, commercial and domestic consumer population. Candidates should have wide practical experience and be capable of dealing with problems arising from electrical contracting and maintenance, tariffs, rural and industrial extensions, the management of showrooms,

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retail selling and all aspects of service to consumers. Corporate Membership of the Institution of Electrical Engineers will be an advantage.

Salary: N.J.B. Class J, Grade 3 (£1,445/£1,605).

Apply by letter to the Manager, Luton District, Eastern Electricity Board, 487 Dunstable Rd, Luton, by 19 Aug., 1960.

Essex Sub-Area

SUB-AREA HEADQUARTERS
NEAR BRENTWOOD
THIRD ASSISTANT ENGINEER
(CONSTRUCTION)
196/60.N.

Candidates should have had a sound technical training and experience in the construction of substations, the erection of overhead lines and the laying and jointing of underground cables at voltages up to 33 kV. Graduate Membership of the Institution of Electrical Engineers would be an advantage.

Salary: N.J.B. Class L, Grade 10 (£1,010/£1,130), plus London Allowance.

Apply by letter to G. M. Holland, M.I.E.E., A.M.B.I.M., Engineer, Essex Sub-Area, Eastern Electricity Board, "Millfield," Bentley, Nr. Brentwood, Essex, by 19 Aug., 1960.

CHELMSFORD DISTRICT
DISTRICT COMMERCIAL ENGINEER
197/60.R.

Candidates should have a sound knowledge of electricity supply tariffs and the utilisation of electrical energy in industrial commercial and domestic premises, and a good general experience of installation and contracting work, retail selling, showroom management and all aspects of service to consumers. Corporate Membership of the Institution of Electrical Engineers or possession of an equivalent qualification in electrical engineering would be an advantage.

Salary: N.J.B. Class F, Grade 4, (£1,080/£1,215).

Apply by letter to the District Manager, D. H. Walker, Esq., A.M.I.E.E., Eastern Electricity Board, Anchor St, Chelmsford, by 19 Aug., 1960.

Norfolk Sub-Area

GREAT YARMOUTH DISTRICT
(a) THIRD ASSISTANT ENGINEER
199/60.R.
(b) FOURTH ASSISTANT ENGINEER
198/60.R.

Candidates for (a) should have had experience in operation and maintenance of H.V. and L.V. overhead and underground systems, including substations and in fault location and protection.

Candidates for (b) should have had sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems, including substations.

Salary: N.J.B. (a) Grade 9 (£845/£930); (b) Grade 11 (£745/£830).

Apply by letter to the District Manager, Eastern Electricity Board, Regent Rd, Great Yarmouth, Norfolk, by 19 Aug., 1960.

Northmet Sub-Area

SUB-AREA HEADQUARTERS, LONDON N.14
GENERAL ASSISTANT ENGINEERS
(ENGINEERING DRAUGHTSMEN)
(a) MAINS DRAWING OFFICE (Ref. 993)
201/60.R.
(b) SUBSTATIONS DRAWING OFFICE
(Ref. 956)
200/60.R.

Candidates for (a) should have had training and experience in overhead line design, layout of associated equipment, survey and route plans, and underground and overhead mains records.

Candidates for (b) should have had a good technical training and experience in the layout of switchgear, transformers and associated equipment for outdoor and indoor substations up to 33 kV.

Salary: N.J.B. (a) and (b) Grade 18 (£690/£785), plus London Allowance.

Apply by letter to the Manager, Eastern Electricity Board, Northmet Sub-Area,

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Northmet Hse, Southgate, London N.14, by 15 Aug., 1960.

BARNET DISTRICT
DISTRICT COMMERCIAL ASSISTANT
202/60.R.

Candidates should have had a sound training and experience in a commercial department of the electrical industry and be capable of estimating for and supervising installation work. A knowledge of space heating, water heating and tariffs is essential.

Salary: N.J.C. Grade 3 (£780/£880), plus London Allowance.

Apply by letter to F. G. Bromley, B.SC.(HONS.)ENG., M.B.I.M., M.I.E.E., Manager, Eastern Electricity Board, 7c High St, Barnet, Herts, by 17 Aug., 1960. (R 561)

South Western ELECTRICITY

APPLICATIONS are invited for the following position:

THIRD ASSISTANT DISTRICT COMMERCIAL ENGINEER (SUPPLY)
TAUNTON

Salary within Class G, Grade 9, Salary Scale 7, £845/£930 per annum of the NJB Agreement.

The successful applicant will be required to give general assistance in the District Commercial Office and duties will include the preparation of Rural Development programmes; assistance with the negotiations of supplies to housing estates, industrial and large commercial consumers; negotiations of street lighting Agreements and assistance to Branches in administrative work connected with these Agreements; development of contracting services throughout the Districts including assistance to Branches with the preparation of specialised Tenders.

Possession of appropriate qualifications at least equal to the Higher National Certificate in Electrical Engineering will be an advantage.

Applications to be made on standard Form AE6/ACT OBTAINABLE BY POSTCARD ONLY from the District Manager, South Western Electricity Board, The Parade, Taunton, Somerset. Closing date for receipt of completed applications is Saturday, 27 Aug., 1960. (R 550)

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for a superannuable position as a SECOND ASSISTANT ENGINEER in the Generation/Operation-Test Section of the Chief Engineer's Department at Board Headquarters.

The successful candidate will be responsible to the Senior Assistant Engineer in charge of the Test Section for the routine and acceptance testing of turbo-generator boilers and other station plant, together with the non-destructive testing of materials and component parts.

Applicants should preferably possess corporate membership of the Institution of Electrical Engineers or the Institution of Mechanical Engineers. Previous experience in the organisation of power plant testing is very desirable.

Salary, N.J.B. Class AX, Grade 5, £1,180/£1,410 per annum.

Applications should be submitted on the standard form which may be obtained from the Secretary, South of Scotland Electricity Board, Inverlair Ave, Glasgow S.4, and returned quoting reference E27/60, not later than 19 Aug., 1960. (R 558)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Northern Area

SECOND ASSISTANT ENGINEER

APPLICATIONS are invited for the above appointment in the Area Engineering Department located at Dingwall, Ross-shire.

Applicants should have experience in the construction, operation and maintenance of electricity networks in a predominantly rural area.

The successful applicant will be required to undertake general duties principally in the Planning Department.

Salary scale N.J.B. Grade 8, Class G, £890/£990.

Minimum technical qualification: Higher National Certificate in Electrical Engineering.

Superannuation Scheme applicable.

Application forms are obtainable from the Area Manager, Church St, Dingwall, which should be returned by Friday, 12 Aug., 1960. (R 553)

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

APPLICATIONS are invited for the following positions:

GRADE 10 ENGINEER (SEC/3.102/ET)
MARCHWOOD GENERATING STATION

The person appointed may be required to undertake shift operational work, control room duties, assist on maintenance work or perform general station duties. Previous experience of modern generating plant is desirable.

Applicants should have a sound technical training and possess qualifications leading to Corporate Membership of an appropriate professional institution, or hold equivalent qualifications.

Salary N.J.B. L/10, £1,010/£1,130.

GRADE 12 ENGINEER (SEC/3.103/ET)
MARCHWOOD GENERATING STATION

The person appointed may be required to undertake shift operational duties, or perform general station duties. Previous experience of modern generating station plant is desirable.

Applicants should have had a sound technical training and preferably possess qualifications leading to Corporate Membership of an appropriate professional institution or hold equivalent qualifications.

Salary N.J.B. L/12, £890/£990.

Special application forms obtainable only from Divisional Secretary, Central Electricity Hse, High St, Portsmouth, should be returned by 15 Aug., 1960. (R 562)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Edinburgh and Borders Area

GENERAL ASSISTANT DISTRICT
COMMERCIAL ENGINEER
LOTHIANS DISTRICT

SALARY: N.J.B. SCHEDULE A, CLASS G, GRADE 11, £745/£830 p.a.

APPLICATIONS are invited for the appointment of a General Assistant District Commercial Engineer in the Lothians District, based on Musselburgh and should be submitted not later than 31 Aug., 1960.

Duties will include the installation and operation of Street Lighting maintenance, liaison with Local Authority Street Lighting Engineers and the maintenance of records. Applicants should have a knowledge of good street lighting practice and be able to carry out photometric tests. Possession of an O.N.C. or equivalent technical qualifications will be an advantage.

Conditions of service are in accordance with the National Joint Board Agreement for the Electricity Supply Industry and the successful candidate, subject to satisfactory evidence of health, will require to become a contributor to the Board's Superannuation scheme.

The successful candidate will require to reside within a reasonable distance of the District Office at Musselburgh.

C. H. A. COLLYNS,
Manager.
(R 544)

THE SOUTH WALES ELECTRICITY BOARD

GENERAL ASSISTANT ENGINEER

APPLICATIONS are invited for the position of General Assistant Engineer, Bridgend District, in the Cardiff and East Central Area of the Board.

Preference will be given to Engineers possessing the Higher National Certificate in Electrical Engineering.

Salary: N.J.B., Class F, Grade 11, Scale 4, £690/£785.

Applications stating age, present position, present salary, qualifications and experience, should be addressed to C. L. Townsend, ASSOCIATE I.E.E., Manager, Cardiff and East Central Area, 445-447 Cowbridge Rd East, Cardiff, so as to arrive not later than 19 Aug., 1960.

Envelopes should be endorsed "General Assistant Engineer—148/60."

R. G. WILLIAMS,
Secretary.
(R 590)

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

APPLICATIONS are invited for the following superannuable appointments in the South Wales Division:

STATION SHIFT CONTROL ENGINEER
USKMOUTH "A" POWER STATION
Vacancy No. 202/ET/60.

Salary: Schedule A, initially Class K, Grade 10, Scale 9, £950/£1,055 per annum, plus 10% shift enhancement, rising progressively to Class M, Grade 10, Scale 11, £1,080/£1,215 per annum, plus 10% shift enhancement.

Applicants should possess H.N.C. or equivalent qualifications, and have had operating experience in a modern Power Station.

PLANT CONTROL ENGINEERS
ROGERSTONE POWER STATION
Vacancy No. 203/ET/60.

Salary: Schedule A, Class G, Grade 10, Scale 6, £800/£875 per annum, plus £90 shift enhancement.

Experience of operation of modern high pressure and temperature unit plant desirable.

Applicants should possess H.N.C. or equivalent qualification.

STATION SHIFT CONTROL ENGINEERS
NEWPORT POWER STATION
Vacancy No. 204/ET/60.

Salary: Schedule A, Class F, Grade 10, Scale 5, £745/£830 per annum, plus £90 shift enhancement.

Applicants should possess H.N.C. or equivalent qualification, and have had operating experience in a Modern Power Station.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 19 Aug., 1960. (R 560)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

Birmingham & District Sub-Area

SENIOR DRAUGHTSMAN
(SUB-AREA ENGINEER'S DEPARTMENT)
(HEADQUARTERS)

Applicants should have had wide experience in the preparation of engineering drawings required for the construction and operation of Transmission and Distribution networks and their associated substations. Knowledge of surveying and mains records routine will be an advantage. Provisional salary £800/£875 per annum within N.J.B. Schedule A. Apply, by letter, within seven days, stating age, experience, present position and salary to Emil Braathen, Sub-Area Manager, Midlands Electricity Board, 14 Dale End, Birmingham 4.

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Worcester & District Sub-Area

SECOND ASSISTANT DISTRICT ENGINEERS
(REDDITCH/BROMSGROVE)

Experience necessary in all Branches of distribution work including construction, maintenance and operation of high and low voltage underground and overhead systems and substations, and the planning of system reinforcements and mains extensions. Technical qualifications desirable. Salary £950/£1,055 per annum (N.J.B. Grade G.7).

Apply, by letter, within 14 days, stating age, experience, present position and salary to Mr W. B. Willis, District Manager, Midlands Electricity Board, Windsor Rd, Redditch, Worcs.

SECOND ASSISTANT DISTRICT ENGINEER
(WORCESTER)

Experience necessary in all Branches of distribution work including construction, maintenance and operation of high and low voltage underground and overhead systems and substations. Technical qualifications desirable. Salary £890/£990 per annum (N.J.B. Grade F.7).

Apply, by letter, within 14 days, stating age, experience present position and salary to Mr E. C. Watson, District Manager, Midlands Electricity Board, P.O. Box No. 16, Blackpole Rd, Worcester.

F. W. CATER
Secretary.
(R 559)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Stirling Area

SECOND ASSISTANT ENGINEER
(PLANNING AND DEVELOPMENT)
AREA HEADQUARTERS, STIRLING
(Vacancy Ref. 58/60)

APPLICATIONS are invited for the above superannuated appointment for which the salary and conditions of service will be in accordance with the National Joint Board Agreement, K.7, £1,155/£1,305 per annum.

The successful candidate will be required to assist the Area Planning and Development Engineer in the design of E.H.V., H.V. and M.V. systems, fault level calculations and load flow investigations, load estimates and negotiations with consumers, etc. Preference will be given to candidates having good experience of these duties and possessing the Higher National Certificate in Electrical Engineering as a minimum technical qualification.

Applications are to be submitted to the undersigned within 14 days of the date of this advertisement on the standard form obtainable from his office.

JAMES G. CURTIS,
Manager.

"Woodlands,"
St. Ninians Rd,
Stirling. (R 547)

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

Vacancy No. 161/60T.
FOURTH ASSISTANT ENGINEER
(SYSTEM DESIGN AND PLANNING)
ELECTRICAL DEPARTMENT
DIVISIONAL H.Q.

CANDIDATES should possess a Degree in Electrical Engineering or equivalent qualification leading to Graduate Membership of the I.E.E. and should be interested in System Design, Load Flow and Fault Current Calculations involving the use of A.C. and D.C. Network Analysers.

N.J.B. Conditions of Service and salary, including London Allowance, Class AX, Grade 11, £775/£980 per annum, with prospect of promotion to Grade 9, £890/£1,105 per annum, subject to satisfactory progress.

Applications giving age, details of experience, qualifications, etc., and quoting vacancy number, to Personnel Officer, South Eastern Division, Lower Ham Rd, Kingston upon Thames, to arrive by 26 Aug., 1960.

W. H. DUNKLEY,
Divisional Controller.
(R 563)

CROYDON

The County Borough of Croydon Education Committee

INVITES applications from suitably qualified teachers for the following posts from September next or as soon as possible.

CROYDON TECHNICAL COLLEGE
FAIRFIELD, CROYDON, SURREY

PRINCIPAL: D. A. GREEN, M.B.E., B.SC., M.ED.

ASSISTANTS GRADE B FOR THE DEPARTMENT OF ELECTRICAL ENGINEERING. The subjects required are Electrical Installation Work and Radio, Television and Electronic Servicing, and applicants are asked to say which of these they can offer.

The salaries for the posts are in accordance with the Burnham Technical Scale of £700/£1,150 plus London Area Allowance, with appropriate allowances and increments for degree, training and previous teaching and industrial experience.

Further particulars and forms of application may be obtained from the Chief Education Officer, Education Offices, Katherine St, Croydon, and should be returned to the Principal not later than 19 Aug. (R 546)

SIERRA LEONE GOVERNMENT

Electricity Department

STATION SUPERINTENDENT

REQUIRED on contract for two tours of 18/24 months each in first instance. Gross salary according to age and experience in scale £1,210 rising to £1,528 a year. Gratuity at rate 15% of total salary drawn. Outfit allowance £60. Children's allowances £48/£228 a year. Free passages. Liberal leave on full salary.

Candidates, between 21-40 years of age, must have served full apprenticeship with electrical engineering company and have had several years' experience of operation and maintenance of power stations in a responsible position. They should preferably hold M.O.T. Cert. (Steam and Diesel) or equivalent. Good knowledge of power station electrical equipment desirable.

Newly qualified mechanical engineers with some practical experience in steam turbines will be considered. Write to the Crown Agents, 4 Millbank, London S.W.1. State age, name in block letters, qualifications and experience and quote M2A/50789/EE. (R 591)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

FOURTH ASSISTANT ENGINEER (TECHNICAL)

REQUIRED at No. 3 Sub-Area Headquarters, Chester. Salary £800/£875 per annum (NJB K/13).

Applicants should have had experience of the testing and commissioning of H.V. electrical plant and its associated protective gear, and should be in possession of suitable technical qualifications.

Appointment subject to medical examination. Pension scheme.

Applications, on forms obtainable from the Manager, No. 3 Sub-Area, Electricity House, Newgate St, Chester, must be forwarded not later than 15 Aug., 1960. (R 552)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

STATION SHIFT CONTROL ENGINEER

REQUIRED at Ocker Hill Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A of the Agreement, Grade G.10, £800/£875 per annum, plus £90 shift allowance.

A sound technical training and practical experience in the control of steam generating plant and main switchgear are required. Appropriate technical qualifications an advantage.

Apply, quoting vacancy number 201/60MD on form AE6, available from the Station Superintendent, Ocker Hill Power Station, Bayleys La, Ocker Hill, Tipton, Staffs, and return completed by 19 Aug., 1960. Previous applicants need not re-apply. (R 574)

ASSISTANT ENGINEER (ELECTRICAL)

REQUIRED for the London Office of the **CROWN AGENTS FOR OVERSEA GOVERNMENTS AND ADMINISTRATIONS** for appointment to pensionable establishment on probation for two years. Commencing salary between £830 at age 25 and £1,125 at age 34 or over in scale rising to £1,300. Fully qualified officers at least 27 years of age may be eligible for special increase of £75 within maximum of scale after two years' service. Liberal leave. Five-day week.

Candidates, preferably between 25 and 35 years of age should have degree in Electrical Engineering or be Corporate Members of the Institution of Electrical Engineers. They should have received their training with established electrical manufacturer, contractor or undertaking and have had subsequent operating or design experience in either medium size thermal power stations, transmission and distribution systems, or consumer's installations. Previous contract experience an advantage.

Duties include purchase of electrical plant and equipment, preparation of specifications for tenders, adjudication of tenders and technical correspondence with Administrations. Write to the CROWN AGENTS, 4 Millbank, London S.W.1 State age, name in block letters, qualifications and experience and quote M2A/51092/EE. (R 549)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

ENGINEERING DRAUGHTSMAN

REQUIRED in the Electrical Engineer's Drawing Office at Divisional Headquarters, Birmingham.

Applicants should have suitable technical training and be capable, under supervision, of preparing detail drawings in connection with the construction of High Voltage Substations.

Salary will be in accordance with either Grades 14, 15 or 16, Class BX of the N.J.B. Agreement within the ranges £615/£830, £570/£785 or £570/£725, according to qualifications and experience.

Applications, quoting vacancy number 202/60MD, should be submitted on the official form AE6 which may be obtained from the Establishments Officer, Central Electricity Generating Board, Midlands Division, 53 Wake Green Rd, Moseley, Birmingham 13. Closing date for receipt of applications 19 Aug. 1960. (R 573)

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEER (MAINTENANCE AND OPERATION) (Z.1230)

OXFORD District of No. 2 (Newbury) Sub-Area. Salary N.J.B. Class J, Grade 11 (£845/£930 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist with the maintenance and operation of H.V. and L.V. distribution mains and substations and with minor construction work. A technical training to H.N.C. standard and experience of similar work are required

ASSISTANT ENGINEER (PLANNING) (Z.1234)

Swindon District of No. 2 (Newbury) Sub-Area. Salary N.J.B. Class G, Grade 10 (£800/£875 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist the Planning Engineer in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks, and to undertake standby duties if required. Applicants should possess suitable technical qualifications.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

Applications for either of these appointments on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting the appropriate "Z" number, not later than 15 Aug., 1960. (R 556)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

SENIOR ASSISTANT COMMERCIAL ENGINEER

REQUIRED at No. 2 Sub-Area Headquarters, Sandiway House, Northwich, Cheshire. Salary within range £1,575/£1,730 per annum (NJB L/4).

Applicants should have a wide experience of industrial and commercial applications, and the development of Domestic and Farm supplies, contracting and sales of appliances.

Appropriate technical qualifications essential.

Appointment subject to medical examination. Pension Scheme.

Application forms obtainable from the Manager at the above address. Closing date: 19 Aug., 1960. (R 548)

SOUTH EASTERN ELECTRICITY BOARD

FITTER (ELECTRICAL)
BRIGHTON AND HOVE DISTRICT

WAGES 5s 1¼d per hour for a 42-hour 5-day week under NJIC Agreement. Candidates should have served a recognised craft apprenticeship and have had experience in the erection and maintenance of high voltage and medium voltage switchgear, transformers and associated control equipment. Contributory pension scheme optional. Applications quoting ET and naming two referees to District Manager, Seeboard, Electric House, Castle Sq, Brighton, by 15 Aug., 1960.

ASSISTANT DISTRICT ENGINEER
WOKING DISTRICT

Class F, Grade 7, under N.J.B. Agreement. Salary £890 x £20/£990 per annum. Superannuable. Applicants, who should have a good general education and be technically trained to H.N.C. standard, must have had practical training and experience in general distribution work on systems up to 11 kV, and be capable of organising and supervising a full construction and maintenance programme. Ability to plan and prepare schemes for mains extensions would be an advantage. Applications, quoting ET and naming two referees on forms from District Manager, Seeboard, 4 Chobham Rd, Woking, by 17 Aug., 1960.

GEORGE WRAY,
Secretary.
(R 551)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

ASSISTANT SHIFT CHARGE ENGINEER

REQUIRED at Ocker Hill Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A Grade G.9, £845/£930 per annum, plus 10% for shift duties (minimum £90).

A sound technical training and practical power station experience are required, in the operation of steam generating plant and main switchgear. Appropriate technical qualifications are an advantage.

Apply, quoting vacancy number 200/60 MD on forms AE6 which are available from the Station Superintendent, Ocker Hill Power Station, Bayleys La, Ocker Hill, Tipton, Staffs, to be completed and returned not later than 19 Aug., 1960.

Previous applicants need not re-apply. (R 572)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Fife Area

DISTRICT COMMERCIAL ASSISTANT

REQUIRED for Western District based on Dunfermline, to undertake consumers' service, operation of Service Centres and supervision of sales and repair workshops: possession of E.D.A. Certificate an advantage.

N.J.C. conditions. Salary: Grade 3, £780/£880. Post superannuable, subject to satisfactory evidence of health.

Applications, on standard form obtainable from Area Manager, S.S.E.B., East Port, Dunfermline, should be returned to him not later than 12 Aug., 1960. (R 598)

SOUTH EASTERN ELECTRICITY BOARD

SENIOR ASSISTANT ENGINEER (PLANNING)
CROYDON AND WEST KENT SUB-AREA HEADQUARTERS

SALARY N.J.B. Class K, Grade 4, £1,445/£1,605 plus London Allowance. Superannuable. Applicants should be corporate members of the I.E.E and have had wide experience of distribution engineering. The duties of the appointment will consist of planning and design of underground and overhead transmission systems up to and including 33 kV also estimating and preparation of schemes for submission for approval. Applications quoting ET and naming two referees on forms from Croydon and West Kent Manager, Seeboard, Electric House, Wellesley Rd, Croydon, by 25 Aug., 1960.

GEORGE WRAY,
Secretary.
(R 557)

LEEDS COLLEGE OF TECHNOLOGY
Calverley Street, Leeds, 1

PRINCIPAL: C. CHEW, M.SC.(TECH.), F.R.I.C.

SENIOR LECTURER IN ELECTRICAL ENGINEERING

REQUIRED on 1 Sept., 1960, or as soon as possible thereafter. Applicants should have a good degree in the subject with industrial and research experience in electronics and telecommunications.

Burnham Technical Scale of salaries, £1,550 x £50—£1,750 a year.

Further particulars and form of application, to be returned as quickly as possible, may be obtained by sending a stamped addressed envelope to the principal of the college.

GEORGE TAYLOR,
Chief Education Officer.

Education Offices,
Calverley St,
Leeds 1. (R 545)

CENTRAL ELECTRICITY GENERATING BOARD
South Western Division

ASSISTANT CHEMIST REQUIRED TO ASSIST THE GROUP CHEMIST BASED AT PLYMOUTH

SUPERANNUATION Scheme. Salary: N.J.B. New Class AX, Grade 11, Scale 7, £735/£930 per annum.

Candidates must have ability to work independently and possess H.N.C. or equivalent qualification. (Please quote ET 106/60.)

Duties will be mainly analytical, but will include investigations of chemical problems throughout the Group. Knowledge and experience of power plant chemical problems essential and a knowledge of metallurgy will be considered an advantage.

Closing date: 12 Aug., 1960.

ASSISTANT ELECTRICAL MAINTENANCE ENGINEER
(Please quote ET 104/60.)

ASSISTANT MECHANICAL MAINTENANCE ENGINEER
(Please quote ET 105/60.)

REQUIRED AT HINKLEY POINT NUCLEAR POWER STATION

Superannuation Scheme. Salary: N.J.B., provisionally within Scale 15, £1,445/£1,605 per annum.

Applicants should have served a recognised apprenticeship and have had experience in power station maintenance. Corporate Membership of the appropriate professional Institution would be an advantage.

Closing date: 16 Aug., 1960.

Applications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by the date stated. (R 582)

A SENIOR ELECTRICAL DRAUGHTSMAN required to participate in the planning and installation of a new Plant involving H.V. and L.V. Switchgear, A.C. and D.C. Motors control gear and electronic equipment. Applications stating age, qualifications, training and subsequent experience to: The Labour Manager, Barrow Steel Works Ltd., P.O. Box No. 16, Walney Rd, Barrow-in-Furness, Lancs. (R 594)

CENTRAL ELECTRICITY GENERATING BOARD

ASSISTANT ENGINEER
(SWITCHGEAR)

required in the Plant Design Section of the Transmission Design Branch in the Transmission Department at Headquarters, London S.E.1.

The selected candidate will be engaged in the development of new substations for voltages up to 600 kV of both conventional and advanced designs, and will assist in the standardisation of substations and the type testing of ancillary equipment.

Applicants should have drawing office experience in the layout of high voltage substations; experience in design and manufacture, or in construction and maintenance of switchgear, is desirable.

Minimum qualifications are Higher National Certificate, or equivalent, and Corporate Membership of the I.E.E. will be a recommendation.

Salary on a scale within the range £970/£1,460 p.a. according to duties and responsibliities.

Applications stating age, qualifications, experience, present position and salary to the Personnel Officer, 24/30 Holborn, London E.C.1, by 22 Aug. Envelopes should be marked "Confidential Ref. ET/283." (R 566)

A VACANCY exists for a TECHNICAL ASSISTANT in the Testing Station at Chadwell Heath, Essex, at a commencing salary of £875 p.a. Applicants are required to have knowledge of protective equipment for high voltage switchgear and cables, supervisory systems and adjustment of their components, experience in fault finding and oil testing. Should have served a recognised apprenticeship and possess technical qualifications.

Apply in writing to the Electric Traction Engineer (London Area) British Railways, Eastern Region, off Ley Street, Ilford, Essex, who will supply details of Conditions of Service, rail travel facilities, sick pay arrangements and Superannuation Scheme. (R 584)

CONTRACT ACCOUNTANT required to carry out billing and other accountancy work in connection with electrical contracting. Pension and bonus schemes in operation. Applications, stating details of age and experience, to Drake and Gorham (Contractors) Ltd., 36 Grosvenor Gdns, S.W.1. (R 503)

CENTRAL ELECTRICITY GENERATING BOARD

PRINCIPAL ASSISTANT

required in the Wayleave Branch of the Secretary's Department at the Board's Headquarters in London.

The duties comprise administrative work in the Wayleave Branch relating to obtaining the statutory consents and clearances required for grid lines.

Candidates should be familiar with the relevant legislation and should have had practical experience of the negotiations and correspondence which such work entails. They should possess the ability to prepare clear and objective written statements, and to conduct negotiations and attend meetings on behalf of the head of the Wayleave Branch.

Salary on a scale within the range £1,430/£1,700 p.a.

Applications stating age, qualifications, experience, present position and salary, to the Personnel Officer, 24/30 Holborn, London E.C.1, by 10 Aug. Envelopes should be marked "Confidential Ref. ET/278." (R 564)

DESIGN ENGINEER for senior position with Electrical Engineers in Westminster. Applicants must have experience of Commercial and Industrial Installations and Instrumentation Systems and be capable of designing to customer's requirements, including preparation of Specifications.

Applications stating age, educational background, qualifications, experience and salary required to Box No. 7941, Electrical Times. (R 515)

ELECTRICAL ENGINEER required for Glasgow Office staff, age 23-28. Applicants (H.N.C. minimum) should have had experience in the manufacture of electrical machines. Progressive salary with non-contributory pension. Applicants, stating age, nationality, qualifications and experience to Britain Engine Boiler and Electrical Insurance Co. Ltd., 98 West George St, Glasgow C.2. (R 597)

ENFIELD-STANDARD POWER CABLES LTD. Contracts Department Drawing Office require SENIOR DRAUGHTSMAN, based Brimsdown (Enfield, Middlesex), experienced Preliminary Planning and Layout Cable Routes and Cable Racking Systems. Apply (full details) Chief Installations Engineer, Contracts Department, Stockingswater La, Brimsdown. (R 593)

RAILWAY ELECTRIFICATION
ASSISTANT FOREMAN REQUIRED
at CHESHUNT—Herts.

Applicants should have served a recognised apprenticeship and be experienced in the installation, repair and maintenance of high voltage switchgear, supervisory control equipment, E.H.T. and L.T. cables, and should have knowledge of isolation procedure.

Technical qualifications desirable.

Pay for 44-hour week is £693 p.a. rising to £734 p.a. after two years. Enhanced pay for overtime and Sunday duty.

Certain free and reduced rate rail travel facilities. Superannuation and Sick Pay Schemes. The successful applicant must pass a medical examination.

Apply in writing to:—

The Electric Traction Engineer (London Area)
British Railways, Eastern Region
Off Ley Street
Ilford, Essex

(R 583)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY

A.E.R.E. HARWELL

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The work offered is varied and interesting, and working conditions are excellent. There are outstanding opportunities for advancement. The Authority has sick leave and superannuation schemes and is at present operating a local assisted transport scheme.

Married men living outside the Harwell transport area accepted for the above posts will be housed within a reasonable time.

Please write for explanatory booklet and application forms to Industrial Recruitment Officer, A.E.R.E. Harwell, Didcot, Berks.

(R 565)

POWER STATION CHEMISTS

Qualified and experienced Chemists required for the Power Stations of the Electricity Supply Commission in the Transvaal and Orange Free State, South Africa.

Generous emoluments according to qualifications and experience. Excellent service conditions including liberal leave. Good prospects of advancement to men of ability, energy and initiative.

Rail and sea passages will be provided for selected applicants, their wives and minor children, subject to agreement to serve the Commission for at least three years.

Chief Chemist from South Africa will interview selected candidates in London. Apply in writing to:

The London Representative,
ELECTRICITY SUPPLY COMMISSION
723/737 The Adelphi
John Adam Street, W.C.2. (Ref: E/263/4)
(R 500)

SWITCHGEAR SALES ENGINEER required for London office of firm specialising in the manufacture of overhead line isolators and fusegear. Should be a trained switchgear engineer and would be responsible for all sales in the Home Counties. Car provided. Applicants should state age, married or single, experience and salary expected. Apply: Ref. WEB/ Switchgear and Equipment Ltd., Southam Rd, Banbury. (R 596)

SUPERVISING ENGINEER required for well-known London electrical contractor, able to handle works of any size from estimate to account. Apply stating age, experience and salary required to Box No. 7947, Electrical Times. (R 589)

EVERSHED AND VIGNOLES LTD. require YOUNG ENGINEERS of O.N.C. electrical engineering standard for their Instrument Division Contracts Department. Expanding opportunities for advancement. Write: Personnel Manager (Ref. 115c), Acton La Works, Chiswick, W.4. (R 586)

ENFIELD-STANDARD POWER CABLES LTD. Contracts Department require a QUALIFIED ELECTRICAL ENGINEER to plan systems and layouts of Power and Control Cables associated with major industrial installations and to commission the circuits after installation. Apply to Contracts Manager, Brimsdown, Middlesex. (R 585)

LIGHTING.—Required for LIGHTING PROMOTION STAFF with imagination, personality, ability to write technical copy, and an aptitude for public speaking. Based in London, the successful applicant will be expected at times to travel the country. Salary according to experience and qualifications. Contributory superannuation scheme.—Box No. 7945, Electrical Times. (R 588)

MARITIME Company in Geneva requires QUALIFIED ELECTRICAL ENGINEER fully conversant with all marine installations and, if possible, also refrigeration installations. Applications with qualifications and salary requirements to Box 7949, Electrical Times. (R 599)

PROVISIONAL BRITISH ELECTRICAL APPROVALS BOARD FOR DOMESTIC APPLIANCES

Applications are invited from qualified electrical engineers for a post in the new organization which is setting up a national approvals scheme for domestic electrical appliances.

It will be a staff appointment, the duties of which will include the control of loading on independent test laboratories, assessment of degree of check testing required, anticipation of future loading, participation in Committee work on matters relating to specifications, standards for approval, test reports. The work and responsibilities will develop as the organisation expands. Career prospects therefore are good.

Experience in the domestic electrical appliances field is desirable.

Commencing salary will be dependent on qualifications and experience, but will not be less than £1,250 with provision for superannuation. Age not more than about 35 years.

Applications in writing to be sent as soon as possible to:

The Director,
British Electrical Approvals Board for Domestic Appliances,
26/27 Cockspur St,
London S.W.1.
(R 595)

HUMPHREYS & GLASGOW

require an ELECTRICAL ASSISTANT to work under an electrical engineer on chemical plant contracts. The work covers power, lighting, testing and commissioning. Minimum standard O.N.C. and age 23-30. Five-day week and contributory pension scheme.

Apply in writing to:

The Chief Engineer,
Humphreys and Glasgow Ltd.,
22 Carlisle Place,
London S.W.1.

(R 568)

SOUTHERN IRELAND—WORKS ENGINEER required by large city factory. The Works Engineer will be responsible to the Works Manager for the maintenance of plant and buildings, and supervision of a small drawing office and workshop. This appointment offers considerable variety and experience, and calls for an imaginative man, preferably with a flair for design and electrical work. The broad requirements are a Mechanical or Electrical Engineering Degree, membership of I.E.E. or I.Mech.E., with considerable experience. Age 25 to 40. Starting salary: £800/£1,200 p.a., depending on experience. Contributory pension scheme. Apply with full details of education, qualifications and career in strict confidence to Managing Director, Box No. 7929, Electrical Times. (R 383)

TECHNICAL SALES ASSISTANT ENGINEER with good National Certificate qualifications and preferably with some experience to sell Transformers, Capacitors and Fuse Switchgear to Industry in Southern England. Salary, Commission, Expenses, with good prospects.—Box No. 7943, Electrical Times. (R 587)

CENTRAL ELECTRICITY GENERATING BOARD

SENIOR ASSISTANT ENGINEERS

Applications are invited for the appointment of SENIOR ASSISTANT ENGINEERS in the Commercial Department at Headquarters, London S.E.1.

The duties will include assisting in the preparation of estimates of the costs of supply of electricity and of steam, of revenue and capital budgets, and detailed work in connection with Bulk Supply Tariffs and tariffs for steam supplies; the preparation of estimates for short- and long-term trading forecasts; the purchase of electricity from outside bodies; investigation of the economic justifications of schemes involving capital expenditure.

Candidates should have a good technical education and engineering experience. Preference will be given to those who are members of a senior Engineering Institution or possess an engineering degree.

Salaries on scales within the range £1,475/£2,080 p.a., according to duties and responsibilities.

Applications stating age, qualifications, experience, present position and salary, to the Personnel Officer, 24/30 Holborn, London E.C.1, by 19 Aug. Envelopes should be marked "Confidential. Ref. ET/282." (R 567)

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HOUSE-SERVICE METERS, all types can be obtained by return from Selectrics, Dept. E.T., Meter Hse, Factory Row, Castle Circus, Torquay. Phone 7218. (R 8)

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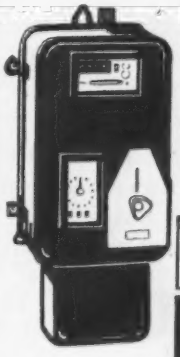

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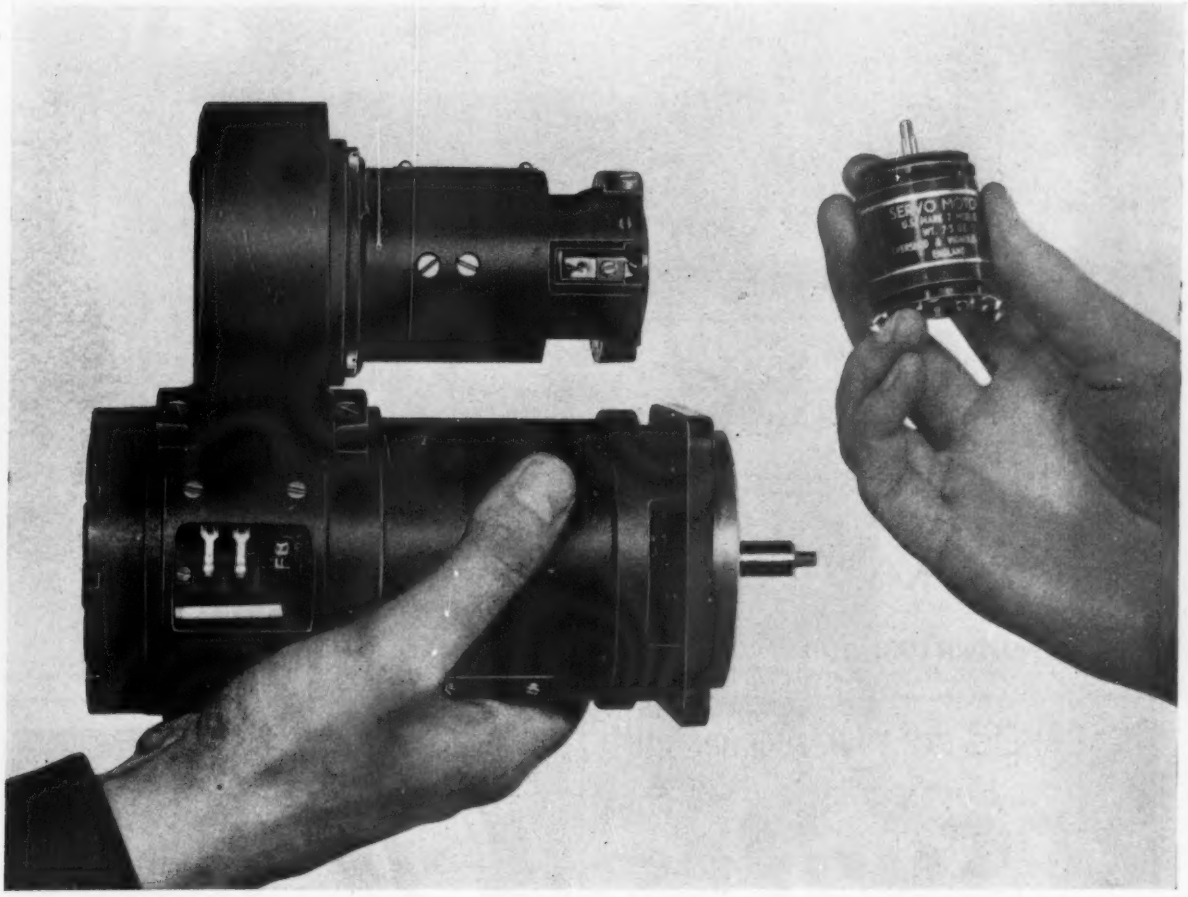

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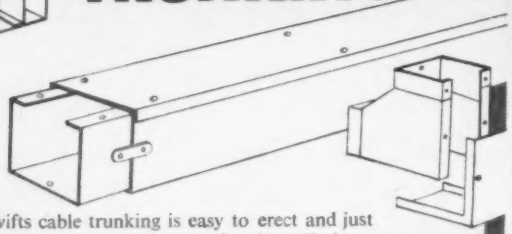

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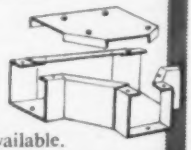

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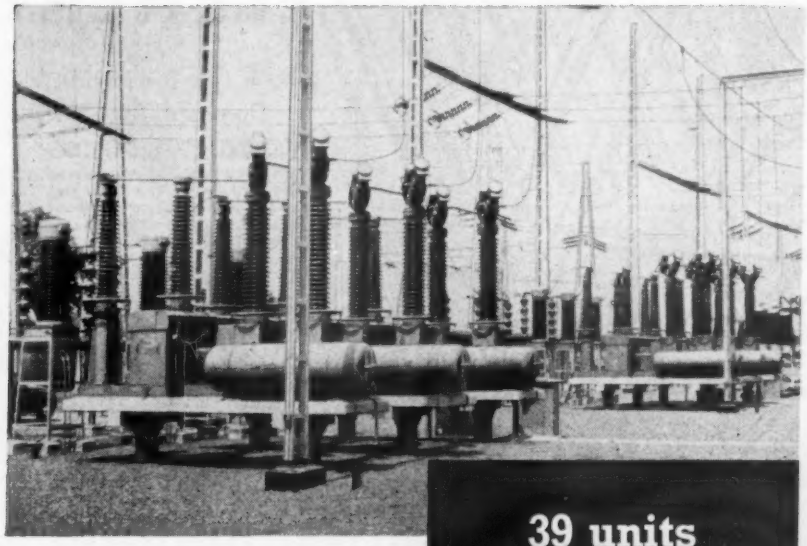

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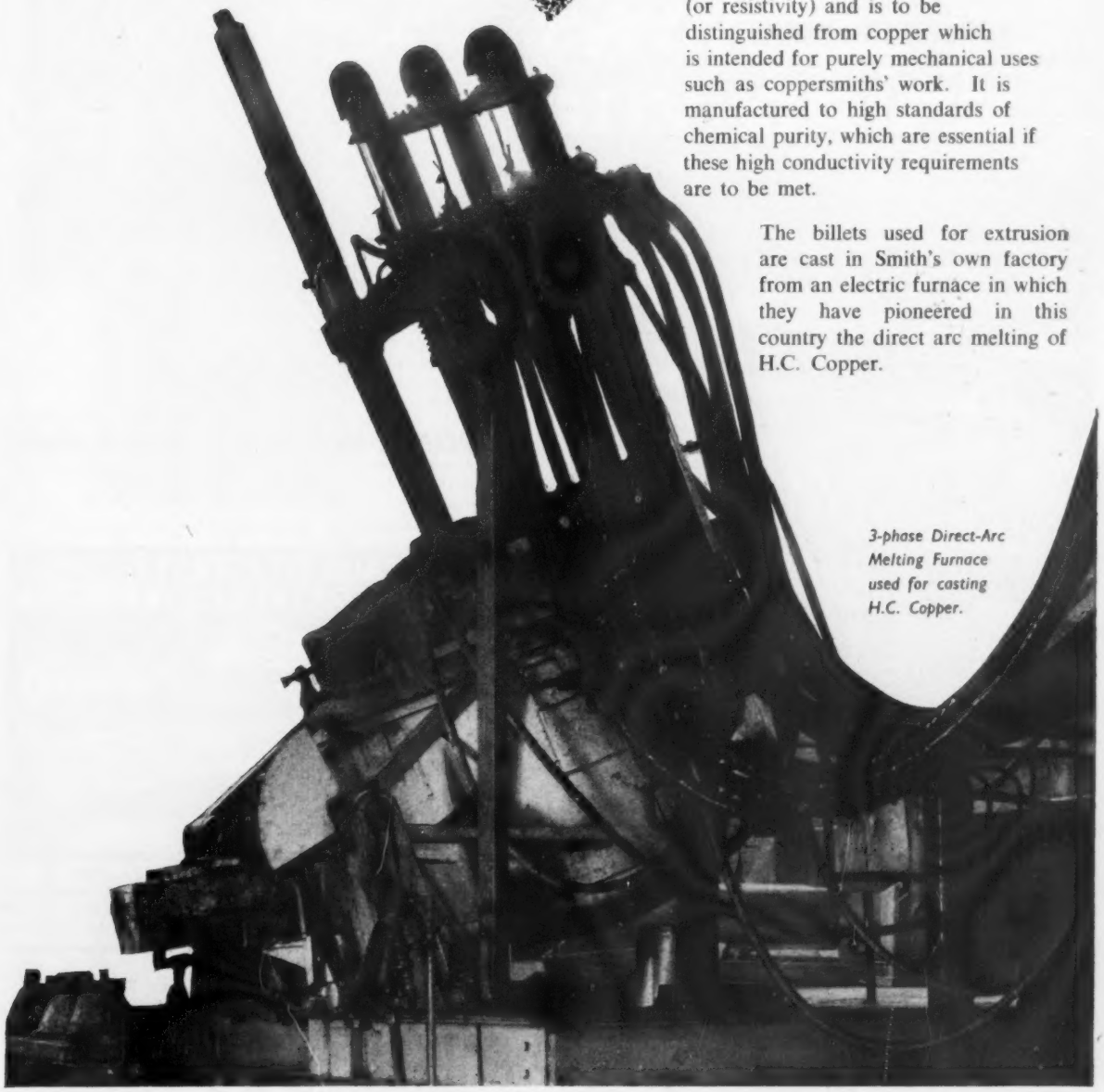

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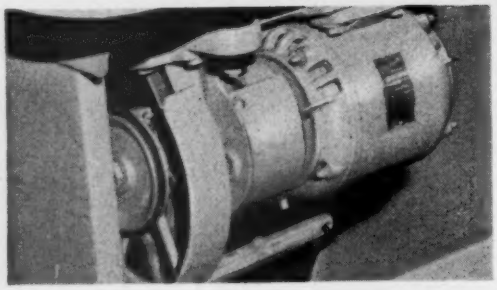

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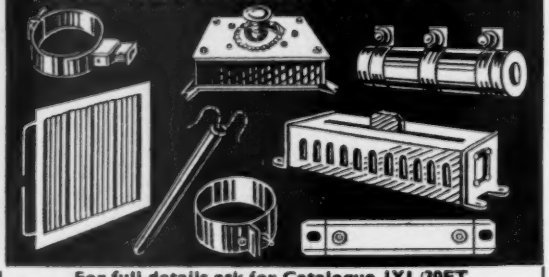

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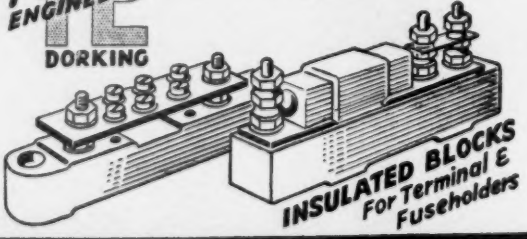

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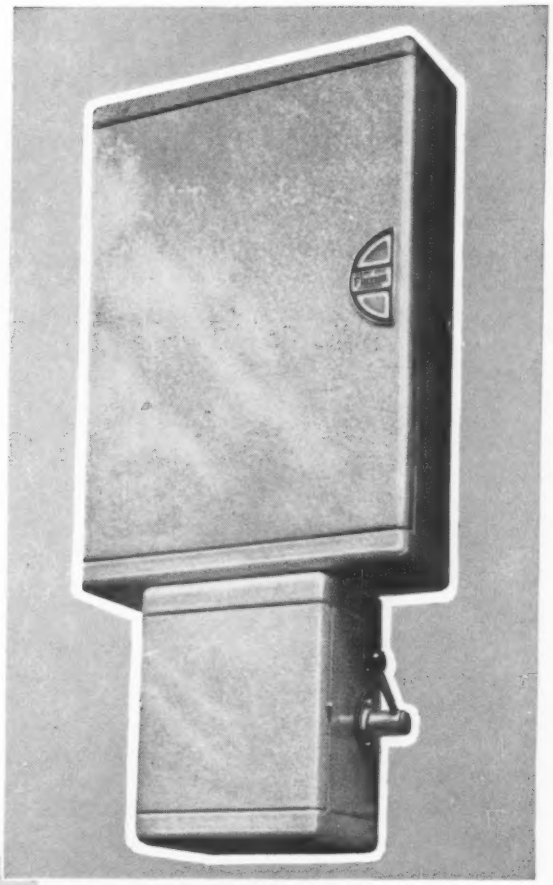
AEROFLEX Fluvent

CABINET STYLE DISTRIBUTION BOARDS



Widespread acceptance of surface mounting Fluvent Cabinet Style Boards has resulted in the production of Switches of similar exterior, intended principally for use as control switches mounted in conjunction with the boards. Both boards and switches have pressed steel cabinets which are cadmium plated and painted to give a grey metallic hammer finish.

The range has been further reinforced by the production of boards for recessed mounting, illustrated right. They are designed to allow the main body of the board to be sunk into a wall cavity of appropriate depth; the plasterwork and wall finish are then made up to the surrounding surface plate provided.

Aeroflex

ENERGY LIMITING FUSES

Fluvent Cabinet Style Distribution Boards are fitted with Aeroflex Energy Limiting High Breaking Capacity Rewireable Cartridge Fuses to BS.88-1952 Cat. 440 AC5 Class P. Standard fully wired cartridge fuse links are included unless otherwise specified, when appropriate underwirings can be fitted.

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